SELECTED WATER RESOURCES ABSTRACTS

VOLUME 2, NUMBER 21
NOVEMBER 1, 1969

W69-08629 -- W69-09028

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SELECTED
WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center,
Office of Water Resources Research, U.S. Department of the Interior

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Use of funds for printing this publication approved by the Director of the Bureau of the Budget, September 4, 1968.

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifers which are listed in the **Water Resources Thesaurus** (November 1966 edition). Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources. WRSIC is not presently prepared to furnish loan or retention copies of the publications announced.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas. Centers, and their subject coverage, now in operation are:

- Ground and surface water hydrology at the Water Resources Division of the U.S. Geological Survey, U.S. Department of the Interior.
- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.

- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Research Institute of Rutgers University.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin, jointly sponsored by the FWPCA, Soap and Detergent Association, and the Agricultural Research Service.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.

In cooperation with the Federal Water Pollution Control Administration, the following "centers of competence" have been established:

- Thermal pollution at the Department of Sanitary and Water Resources Engineering of Vanderbilt University.
- Textile wastes pollution at the School of Textiles of North Carolina State University.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
Information Center
Office of Water Resources Research
U.S. Department of the Interior
Washington, D. C. 20240

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01 NATURE OF WATER
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02 WATER CYCLE
Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

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ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

02. WATER CYCLE

2A. General

USING RUNOFF EVENTS TO CALIBRATE SMALL FORESTED CATCHMENTS,
Forest Service (USDA), Oxford, Miss. Southern Forest Experiment Station.
For primary bibliographic entry see Field 07B.
W69-08641

HYDROLOGY OF THE ALAKAI SWAMP, KAUAI, HAWAII,
Hawaii Agricultural Experiment Station, Honolulu.
Bessel D. van't Woudt, and Robert E. Nelson.
Hawaii Agricultural Experiment Station Bulletin 132, 30 p, January 1963. 13 fig, 5 tab, 19 ref.

Descriptors: *Hydrologic budget, *Swamps, *Wet climate, Hawaii, Peat, Moisture content, Streamflow, Photogrammetry, Terrain analysis.
Identifiers: Alakai Swamp, Kauai.

The Alakai Swamp, about 4,000 feet in elevation, is continuously moisture-saturated, the result of about 250 inches of rainfall well distributed throughout the year. It acts mainly as a collecting and overflow basin with limited surface-storage capacity. (Merriam-Forest Serv)
W69-08649

MULTIVARIATE METHODS USEFUL IN HYDROLOGY,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
For primary bibliographic entry see Field 07B.
W69-08661

GEOMORPHOLOGY AND SURFACE HYDROLOGY OF DESERT ENVIRONMENTS,
Arizona Univ., Tucson.
Lawrence K. Lustig.
IN W. G. McGinnies, B. J. Goldman, and Patricia Paylore, Eds., Deserts of the World, an Appraisal of Research into their Physical and Biological Environments, IV University of Arizona Press, Tucson, 1967. 189 p, refs.

Descriptors: *Geomorphology, *Surface drainage, *Deserts, Drainage patterns (Geologic), Topography, Arid climates, Dunes, Semiarid climates, Aeolian soils, Surface waters, Hydrology, Arid lands, Channel morphology.
Identifiers: Kalahari Desert, Namib Desert, Sahara Desert, Somali-chalbi Desert, Arabian Desert, Iranian Desert, Thar Desert, Australian Deserts, Monte-Patagonia Desert, Atacama-Peruvian Desert, North American Deserts.

A survey on the state of knowledge of geomorphology and surface hydrology of the world's arid regions (excluding O.S.S.R. and China). Backgrounds of modern geomorphic concepts are discussed. The detailed review of information evaluates each of the world's deserts separately, indicating authorities and depositories. Political subdivisions (nations; USSR, states) are employed. Desert definition is considered in terms of basic climatic data, mean annual values, and expansion and contraction of deserts. Equilibrium of desert landforms (ie. plains, topographic lows, topographic highs, alluvial fans and pediments) is considered as the central problem of arid lands geomorphology. The basic problems in the study of desert drainage and mapping are treated. Recommendations include establishment of basic data stations on transect lines perpendicular to presumed boundaries and extending from semiarid to extremely arid, treatment of precipitation data in terms of some parameter such as kurtosis (which relates frequency distribution), use of quantitative descriptive techniques of landforms, determination of current processes and rates, development of a quantitative scale of rock weathering, and a search for some physical characteristics of stream channels that will serve as accurate guides to the probable discharge and frequency of discharge of desert drainage. Includes comprehensive bibliography of approximately 2,500 refs. (Sherbrooke-Ariz)
W69-08689

HYDROLOGY OF THE USSR ARID REGIONS (RUSSIAN),
State Hydrological Inst., Leningrad (USSR).
K. P. Voskresenskiy.
Trudy Gos Gidrol Inst, No 163, p 19-29, 1968. 11 p, 2 tab.

Descriptors: *Hydrology, *Arid lands, Humidity, Air circulation, Water resources, Water supply, Water users, Discharge (Water), Precipitational (Atmospheric), Climates, Water loss, Filtration, Desalination, Hydraulic engineering, Soils, Evaporation.
Identifiers: *USSR, Arid regions.

The author describes the over-all picture of USSR river discharges, with special attention given to the river discharges of the Aral-Caspian, CisAsov, and Barabinsk-Achinsk-Yeniseysk regions considered to be the dryest ones in the Soviet Union. The Pacific and Arctic Ocean basins are characterized by a runoff of 10.5 lit/sec per sq km, whereas the dry basins contribute only from 0.1 to 2.0 lit/sec per sq km. The author points out that these arid regions, in spite of their lack of water resources, are of importance in the economy of the USSR. Several steps are suggested to increase the supply and use of fresh waters in the arid regions. (Gabriel-USGS)
W69-08735

HARMONIC ANALYSIS OF THE MOUNTAIN RIVER HYDROGRAPH (RUSSIAN),
Tadzhikskii Selsko Khoziaistvennyi Institut, Dushanbe (USSR).
For primary bibliographic entry see Field 02E.
W69-08773

ACTIVATION ANALYSIS: A NEW TECHNIQUE FOR SOIL MOVEMENT STUDIES,
Iowa State Univ., Ames.
For primary bibliographic entry see Field 07B.
W69-08835

DIGITAL COMPUTER SIMULATION IN HYDROLOGY,
Geological Survey, Menlo Park, Calif. Water Resources Div.
For primary bibliographic entry see Field 07C.
W69-08893

GROUND WATERS AND SURFACE WATERS OF THE BURIAT-MONGOLIAN A.S.S.R. AS A SOURCE OF AGRICULTURAL WATER SUPPLY (RUSSIAN),
For primary bibliographic entry see Field 02F.
W69-08912

A COASTAL POND STUDIED BY OCEANOGRAPHIC METHODS,
Woods Hole Oceanographic Institution, Mass.
For primary bibliographic entry see Field 02H.
W69-08922

SEISMIC INVESTIGATION OF ICE PROPERTIES AND BEDROCK TOPOGRAPHY AT THE CONFLUENCE OF TWO GLACIERS, KASKAWULSH GLACIER, YUKON TERRITORY, CANADA,
Ohio State Univ. Research Foundation, Columbus. Inst. of Polar Studies.
For primary bibliographic entry see Field 02C.
W69-08924

THE EFFECT OF MINGECHAUR RESERVOIR ON THE THERMAL REGIME OF THE LOWER REACHES OF KURA RIVER (RUSSIAN),
Akademiya Nauk SSSR.
For primary bibliographic entry see Field 02E.
W69-08925

HEAT CONDUCTIVITY OF WATER-BEARING SATURATED ROCKS AS A FUNCTION OF PRESSURE, TEMPERATURE, AND ROCK COMPOSITION (RUSSIAN),
Akademiya Nauk SSSR.
For primary bibliographic entry see Field 02F.
W69-08926

THE EFFECTS OF DENSITY OF RECORDING RAIN GAUGE NETWORKS ON THE DESCRIPTION OF PRECIPITATION PATTERNS,
California Univ., Davis. Dept. of Water Science and Engineering.
J. Amorocho, A. Brandstetter, and Don Morgan.
Symp on Geochem, Precipitation, Evaporation, Soil-Moisture, Hydrom, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 78, p 189-202, 1968. 14 p, 6 fig, 6 tab, 2 ref.

Descriptors: *Networks, *Rain gauges, *Distribution patterns, *Rainfall-runoff relationships, *Depth-area-duration analysis, Model studies, Mathematical models, Statistical methods, Hydrologic data, Hyetographs, Hydrographs, Radar, Rainfall disposition.
Identifiers: Rain gauge networks, Hydrologic models.

Methods based on mathematical filtering processes applied to data from dense recording precipitation gage networks have led to the development of criteria for the determination of the effect of network densities on the definition of significant storm patterns. The application of 1 of these procedures to the analysis of storms in the Central Valley of California is reported. The experiments involve the use of over 20 battery-driven, digital recording rain gauges distributed in a special array covering an area of approximately 10 sq mi. The evolution of the storm precipitation patterns over the area is investigated by means of the data from the network in conjunction with radar echo observations. The spacings required for adequate areal pattern definition were studied, and a procedure for the correction of systematic local effects on each rain gauge was found to be sufficient to make the individual gauge data hydrologically equivalent. (Knapp-USGS)
W69-08931

RAINFALL INPUT FOR HYDROLOGIC MODELS,
Agricultural Research Service, Beltsville, Md. Hydrograph Lab.
David M. Hershfield.
Symp on Geochem, Precipitation, Evaporation, Soil-Moisture, Hydrom, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 78, p 177-188, 1968. 12 p, 12 fig, 1 tab, 4 ref.

Descriptors: *Rainfall-runoff relationships, *Duration curves, *Depth-area-duration analysis, Hydrologic data, *Networks, Rain gages, Model studies, Hyetographs, Hydrographs, Hydrograph analysis, Distribution patterns, Storms, Runoff, Correlation analysis.
Identifiers: Rainfall models, Hydrologic models.

A study of more than 300 rainstorms, 15 major events in each of 23 densely gaged watersheds, shows that direction of rain gage distribution is often more important than gage density in defining the characteristic dimensions of the rainfall distribution. Rainfall volume appears to be estimated adequately with only a small number of properly located gages as compared with that required for good definition of the isohyetal pattern. The depth-area curves for individual storms are generally similar in shape and direction within a watershed.

Examples are presented of time distribution and rainfall progression over the watershed. (Knapp-USGS)
W69-08932

MONSOON OVER THE INDUS VALLEY DURING THE HARAPPAN PERIOD,
Council of Scientific and Industrial Research, New Delhi (India).
For primary bibliographic entry see Field 02F.
W69-08950

TERRESTRIAL, ATMOSPHERIC AND SOLAR RADIATION FLUXES ON A HIGH DESERT MOUNTAIN IN MID-JULY: WHITE MOUNTAIN PEAK, CALIFORNIA,
California Univ., Los Angeles. Dept. of Geography.
Werner H. Terjung, Ronald N. Kickert, Gerald L. Potter, and Stanley W. Swarts.
Solar Energy, Vol 12, No 3-F, p 363-375, 1969. 13 p, 8 fig, 2 tab, 17 ref.

Descriptors: *Solar radiation, *Climatology, *California, Hydrologic cycle, Weather, Meteorology, Energy budget.
Identifiers: White Mountain Peak (Calif).

Solar radiation was measured on White Mountain Peak, California, in July at an altitude of 14,000 feet. The summed net radiation was about 575 ly and heat flux into ground was about 14 ly. Such high solar radiation is more than theory predicts for the location, and possibly the highest recorded on the Earth's surface. (Knapp-USGS)
W69-08951

2B. Precipitation

MEASUREMENT AND ESTIMATION OF PRECIPITATION ON EXPERIMENTAL WATERSHEDS,
Forest Service (USDA), Berkeley Calif. Pacific Southwest Forest and Range Experiment Station.
Edward S. Corbett.
International Symposium on Forest Hydrology, Proceedings, Pennsylvania State University, p 107-129, Aug 29-Sept 10, 1965.

Descriptors: *Precipitation (Atmospheric), *Precipitation gages, *Measurement, Demonstration watersheds, Rain, Sampling, Gaging stations, Isohyets, Variability, Climatic data, Network design, Theis equation.
Identifiers: Point sampling, *Experimental watersheds.

The literature pertinent to the measurement of precipitation (primarily rainfall) on watersheds is reviewed. Topics discussed include types of rain gages, accuracy of point rainfall measurements, selection of rain gage sites, precipitation variability and its effects on rain gage network designs, and extrapolation of point precipitation values to areal estimates. (Author)
W69-08653

PROBLEM OF THE STATISTICAL STRUCTURE OF THE FIELD OF WINTER PRECIPITATION,
Main Geophysical Observatory, Leningrad (USSR).
A. I. Polishchuk.
Soviet Hydrol: Selec Pap, Issue No 2, p 147-149, 1968. 3 p, 2 fig, 1 tab, 8 ref. Trans Trudy Gos Geophys Observ, No 215, p 153-156, 1968.

Descriptors: *Precipitation (Atmospheric), *Correlation analysis, *Precipitation gages, Networks, Statistical methods, Snowfall, Rainfall, Rainfall disposition, Winter.
Identifiers: *USSR, Precipitation structure (Statistical).

The statistical structure of winter precipitation at 15 USSR precipitation stations was analyzed. Methods of correction of monthly precipitation sums were evaluated. The space correlation function was found by averaging the correlation coefficients for pairs of stations and relating the average correlation coefficients to station separation distance. Correlation coefficients are tabulated, and correlation functions are shown by graphs. (Knapp-USGS)
W69-08726

MICROSPHERULES IN SNOW AND ICE-FOG CRYSTALS,
Army Terrestrial Sciences Center, Hanover, N.H.
Motoi Kumai.
Cold Reg Res and Eng Lab Res Rep No 245, Mar 1969. 10 p, 4 fig, 2 tab, 29 ref.

Descriptors: *Precipitation (Atmospheric), *Nucleation, *Ice, *Snow, *Fog, Arctic, Cold regions, Alaska, Freezing, Clays, Air pollution, Smoke.
Identifiers: Ice crystal nucleation, Ice fog, Microspherules.

Spherules found in snow crystals, ice-fog crystals, fallout particles, and fly ash were studied with an electron microscope using the electron diffraction method. The central part of the residues of 1004 specimens of natural snow crystals from Greenland, the United States, and Japan were examined; 14 spherules 0.1 to 1.5 microns in radius were found among them. The residues of 658 artificial ice-fog crystals formed from water vapor in flue gases of coal-burning electric power plants at Fairbanks, Alaska, were also examined; 9 spherules were found. Spherules similar to those found in ice-fog residues were found in furnace-produced fly ash fallout at Fairbanks, Alaska. The electron microscope study indicated that less than 0.7% of the 1004 snow crystals are formed mainly on clay mineral particles by heterogeneous nucleation. (Knapp-USGS)
W69-08907

OBJECTIVE ASSESSMENT OF ADEQUATE NUMBERS OF RAINGAUGES FOR ESTIMATING AREAL RAINFALL DEPTHS,
British Meteorological Office, Bracknell (England).
P. M. Stephenson.
Symp on Geochem, Precipitation, Evaporation, Soil-Moisture, Hydrom, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 78, p 252-264, 1968. 13 p, 8 fig, 7 tab, 3 ref.

Descriptors: *Network design, *Rain gages, *Rainfall disposition, *Distribution patterns, *Statistical methods, Hydrologic data, Regression analysis, Correlation analysis, Probability, Isohyets, Estimating.
Identifiers: *United Kingdom, Rain gage distribution, Rain gage networks.

The assessment of the minimum number of raingages required to measure the depth of rainfall over an area within given limits of accuracy is discussed. Standard computations are not necessarily universally applicable and need to be related to the type of precipitation and the nature and size of the particular area under consideration. An approach is suggested to a solution of the problem for monthly rainfall using a largely objective statistical technique for different classes of precipitation over areas of England and Wales varying in size from a few tens of square kilometers to the whole country. The results are presented in graphical and tabular form, relating the minimum number of gages required to size of area. For small areas the results are in close accord with those previously determined empirically and used in the British Meteorological Office for planning networks. For larger areas considerable fewer gages than customarily recommended appear to be adequate. An appendix gives the results of other approaches to the problem using more limited data but also attempting a solution for daily rainfall. (Knapp-USGS)
W69-08928

ON THE POSSIBILITY OF QUANTITATIVELY EXTENDING PRECIPITATION RECORDS BY MEANS OF DENDROCLIMATOLOGICAL ANALYSIS,
National Center for Atmospheric Research, Boulder, Colo.; and Arizona Univ., Tucson. Lab. of Tree-Ring Research.
P. R. Julian, and H. C. Fritts.
Symp on Geochem, Precipitation, Evaporation, Soil-Moisture, Hydrom, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 78, p 243-251, 1968. 9 p, 4 fig, 1 tab, 8 ref.

Descriptors: *Paleoclimatology, *Climatology, *Dendrochronology, Dating, Ecology, Forests, Plant growth, Precipitation (Atmospheric), Statistical methods, Regression analysis, Correlation analysis.
Identifiers: *Dendroclimatology.

The plant-physiological basis for expecting annual tree-ring growth in appropriate environments to be related to climate is briefly reviewed. Emphasis is placed upon statistical techniques designed to relate tree-ring growth indices to observed climatic parameters. Four major problem areas for statistical analyses are specified and new techniques described. These are (1) the objective classification of the sampled tree sites as to sensitivity and other desirable characteristics for dendroclimatic purposes, (2) the removal of growth trends assumed unrelated to climated variation, (3) the selection of a linear multiple regression model specifying that combination of climatic elements best related to tree-ring index series, and (4) examination of the spatial- and temporal-scale variations in the regression relation. The optimum sites specified by the characteristics of the sampled tree-ring series are best related to a weighted combination of precipitation preceding the growing season. Time-scale fluctuations with periods shorter than 10 yr are somewhat better related than longer period fluctuations. Spatial variability is apparently complicated, but statistically significant regression relations can be found for optimum sites up to 50 km from the precipitation recording station. The derived relationships are used to attempt the extrapolation of relevant precipitation statistics backward in time for semi-arid regions of the Western United States. (Knapp-USGS)
W69-08929

A MEASURE OF THE SNOW PRECIPITATION (FRENCH),
Alpine Glaciology Lab., Grenoble (France).
Andre Poggi.
Symp on Geochem, Precipitation, Evaporation, Soil-Moisture, Hydrom, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 78, p 237-242, 1968. 6 p, 2 fig, 9 tab.

Descriptors: *Precipitation gages, *Snowfall, *Rainfall, *Instrumentation, Water equivalent, Sampling, Lysimeters, Snowpacks.
Identifiers: *France.

The performance of snow gages used in France is reviewed. Snow-catch by gages varies approximately inversely as the area of the receiving surface of the gage, whereas rain-catch varies with the area. The use of Alter's shield does not improve snow-gaging results in clearings, and actually causes poorer rain-gaging results. The difference between gaged water equivalent and meltwater measured by a lysimeter varied between 1.0 and 2.6%. In a field 100 m long and 50 m wide, snow sample measurements and storage gage measurements correlated well, with differences of 1.5 and 4.5% compared to snowgage measurements. (Knapp-USGS)
W69-08930

THE EFFECTS OF DENSITY OF RECORDING RAIN GAUGE NETWORKS ON THE DESCRIPTION OF PRECIPITATION PATTERNS,
California Univ., Davis. Dept. of Water Science and Engineering.
For primary bibliographic entry see Field 02A.
W69-08931

RAINFALL INPUT FOR HYDROLOGIC MODELS,
Agricultural Research Service, Beltsville, Md. Hydrograph Lab.
For primary bibliographic entry see Field 02A.
W69-08932

THE ATTENUATION AND BACKSCATTERING OF INFRARED RADIATION BY ICE FOG AND WATER FOG,
Army Terrestrial Sciences Center, Hanover, N. H.
Motoi Kumai, and Jack D. Russell.
Cold Reg Res and Eng Lab Res Rep No 264, Apr 1969. 7 p, 3 fig, 4 tab, 10 ref.

Descriptors: *Fog, *Cold regions, *Ice, *Infrared radiation, *Alaska, Light, Absorption, Optical properties, Physical properties, Particle size, Temperature, Meteorology.
Identifiers: Ice fog, Light attenuation.

By reducing visibility, ice fog hampers the normal flow of traffic during severe cold weather conditions in subarctic countries. In addition, ice fog can cause extinction of the infrared beam in an infrared guidance system. Because of this, the emphasis of CRREL's ice fog research is being placed on the effects of ice fog on infrared transmission. This report presents results of a study of attenuation and backscattering of infrared radiation by fog in Alaska. (Knapp-USGS)
W69-08943

FOG MODIFICATION STUDIES ON THE GREENLAND ICE CAP,
Army Terrestrial Sciences Center, Hanover, N.H.
Motoi Kumai.
Cold Reg Res and Eng Lab Res Rep No 258, Mar 1969. 9 p, 9 fig, 1 tab, 8 ref.

Descriptors: *Fog, *Condensation, *Cloud seeding, *Chemistry of precipitation, *Cold regions, Arctic, Meteorology, Precipitation (Atmospheric), Weather modification, Nucleation, Freezing.
Identifiers: *Greenland, Fog modification, Ice nucleation.

During the summer of 1965, the CRREL cloud physics group carried out a study of fog modification by propane and dry ice seeding on the Greenland Ice Cap, an area with one of the lowest concentrations of atmospheric pollution on earth. The nuclei of supercooled fog droplets before seeding were observed using electron microscopy and electron diffraction methods. The nuclei of ice crystals formed by dry ice and propane seeding were also observed using the same technique. The nuclei of the supercooled fog droplets and the ice crystals formed by seeding were found to be hygroscopic sea salt particles that were easily distinguished from the clay mineral nuclei of natural snow crystals. The sublimation temperature of carbon dioxide is -78.5C. The boiling point of liquid propane is -44.5C at 1 atm pressure. It is concluded that the ice nucleation of supercooled fog by dry ice and liquid propane seeding is due to thermal effects. (Knapp-USGS)
W69-08960

FORMATION AND REDUCTION OF ICE FOG,
Army Terrestrial Sciences Center, Hanover, N.H.
Motoi Kumai.
Cold Reg Res and Eng Lab Res Rep No 235, Mar 1969. 21 p, 9 fig, 8 tab, 3 ref, 1 append.

Descriptors: *Fog, *Ice, *Alaska, *Freezing, *Aerosols, Air pollution, Clouds, Condensation, Meteorology, Cold regions, Water vapor.
Identifiers: *Ice fog, Fairbanks (Alaska).

During January and February of 1962-64, Fairbanks, Alaska, and vicinity was the site of a series of studies dealing with ice fog and ice crystals. Results of an investigation of the amount and extent of air pollution and ice fog in the area are presented with special emphasis on reducing ice fog by decreasing the water vapor being emitted into the atmosphere. The major sources of water vapor at the 2 military installations in the region, Fort Wainwright and Eielson AFB, are the heating and powerplants and their associated cooling ponds. In the populated areas around Fairbanks, a high aerosol concentration of about 100,000 particles/cu cm exists, whereas in the uninhabited areas the concentration is extremely low (about 300 particles). Much of the high concentration is due to the burning of coal for heat and power. Because the coal is of low grade it also emits about 350,000 kg of water vapor into the atmosphere on a day when the temperature is -40C. This water vapor condenses on the aerosols and produces ice fog. Anthracite or semi-bituminous coal would reduce the water vapor output to only 1/5 of the amount produced by the low grade coal. Water vapor from cooling ponds can be reduced by freezing the surfaces of the ponds. (Knapp-USGS)
W69-08961

INFLUENCE OF TOPOGRAPHY ON RAINFALL IN WEST VIRGINIA,
West Virginia Univ., Morgantown, W. Va. Water Research Inst.
C. R. Grafton, and W. H. Dickerson.
Water Research Institute Bulletin 1, 1969. 45 p. OWRR Project A-006-WVA.

Descriptors: *Rainfall, *Rainfall disposition, *Distribution patterns, *Topography, *Statistical models, Elevation, Climatic zones, Regression analysis, Correlation analysis, West Virginia.
Identifiers: *Rainfall patterns, *Topographic influences, Computed estimation values.

The influence of topography and geographical position on mean annual precipitation was investigated by correlation and regression analysis. Of the several influences studied, elevation above sea level (actually elevation squared), latitude, and climatic division elevation deviation (a measure of the difference in elevation of the station and the mean elevation for its climatic division) proved to be the most important for the Eastern Zone. For the Western Zone, elevation, rise (a measure of the difference in elevation between the location and nearby higher land forms), and climatic division (indexed by the mean rainfall for the division in which the station was located) were the most significant of the independent variables tried. The zone dichotomy was based on a division of the state into lee and windward areas with the line of demarcation running generally northeast--southwest along the highest elevations of the mountains. Elevation accounted for about 50 percent of the variance in annual precipitation and the coefficient of multiple determination was increased to 0.66 and 0.60 (Eastern and Western Zone, respectively) by inclusion of the additional parameters. (Dickerson-W Va)
W69-09027

2C. Snow, Ice, and Frost

DENSITY VARIATION IN A SNOWPACK OF NORTHERN NEW MEXICO,
Forest Service (USDA), Albuquerque, N. Mex. Rocky Mountain Forest and Range Experiment Station.
Howard L. Gary.
Western Snow Conf Proc, 35th Annual Meeting, Boise, Ida, April 18-20, 1967. p 6-10, illus.

Descriptors: *Density stratification, *Water equivalent, *Snowpacks, *Snow surveys, Snow cover, Snowmelt, Snow management, Mountain forests, Watershed management, New Mexico.

Discusses sample variability of horizontal density measurements in snow profiles. The descending order of average sample variation in density was new snow, depth hoar, dry snow, and wet snow. (Author)
W69-08644

SNOW ACCUMULATION AND DISAPPEARANCE BY ASPECT AND VEGETATION TYPE IN THE SANTA FE BASIN, NEW MEXICO,
Forest Service (USDA), Albuquerque, N. Mex. Rocky Mountain Forest and Range Experiment Station.
Howard L. Gary, and George B. Coltharp.
US Forest Serv Res Note RM-93, 1967. 11 p, illus.

Descriptors: *Snowpacks, *Snow management, *Snow cover, *Water equivalent, *Snowmelt, *Watershed managment, Snow surveys, Water yield, Snowfall, Mountain forests, Coniferous forests, Water yield improvement, New Mexico.
Identifiers: North-south aspects.

Plots on north and south aspects under Douglas-fir, aspen, spruce-fir, and grass cover had maximum snow water equivalents ranging from 7.6 inches on the south-aspect Douglas-fir to 14.5 inches on the south-aspect grass plot. Greatest snow accumulations were observed in the high-elevation spruce-fir and grass types. In this elevation zone there was little difference in accumulation and melt between north and south aspects. Snow melting continued 4 to 5 weeks longer under spruce-fir than under other cover types. Watershed management recommendations are given. (Author)
W69-08645

CLASSIFICATION OUTLINE FOR SNOW ON THE GROUND,
Forest Service (USDA), Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station.
R. A. Sommerfeld.
Forest Service Research Paper RM-48, p 1-24, 1969. 14 fig, 4 ref.

Descriptors: *Snow cover, *Metamorphism, *Classification, Snow, Firn, Glaciers, Crystal growth, Ice.

A classification of snow on the ground is presented in outline form, with explanations and illustrations of the categories. The classification is based on the physical processes which result in various forms of snow particles. Thus it should be an aid in understanding the physical changes occurring as a snowpack metamorphosis. A list of words commonly used in discussions of snow metamorphism is presented since these words have often been misused. (Author)
W69-08666

CLATHRATE HYDRATES OF AIR IN ANTARCTIC ICE,
California Univ., San Diego, La Jolla. Dept. of Chemistry.
For primary bibliographic entry see Field 02K.
W69-08695

ESTIMATE OF THE RELIABILITY OF THE CHARACTERISTICS OF THE SHORTAGE IN SOLID PRECIPITATION DUE TO WIND,
Main Geophysical Observatory, Leningrad (USSR).
For primary bibliographic entry see Field 07B.
W69-08725

THICKNESS CHARACTERISTICS OF ICE ON THE PRIPYAT' RIVER,
Ministry of Melioration and Water Resources Management (USSR).
N. V. Zhitskaya.
Soviet Hydrol: Selec Pap, Issue No 2, p 161-168, 1968. 8 p, 5 fig, 3 tab, 7 ref.

Descriptors: *Ice, *Freezing, *Rivers, Heat budget, Statistical methods, Forecasting, Water supply, Streamflow forecasting, Flood forecasting.
Identifiers: *USSR, Pripyat' River, River ice formation.

The growth of the ice cover on the Pripyat' River, USSR was measured and methods of forecasting ice-cover growth by standard statistical methods were developed. Empirical formulas were obtained to relate ice growth to meteorological and hydrological factors. Graphs are presented relating ice growth to snow depth, temperature, length of cold periods, and thickness of ice already formed. (Knapp-USGS)
W69-08733

STABILITY OF DAMS IN PERMAFROST AREAS,
Alaska Univ., College.
For primary bibliographic entry see Field 08D.
W69-08862

MICROSPHERULES IN SNOW AND ICE-FOG CRYSTALS,
Army Terrestrial Sciences Center, Hanover, N.H.
For primary bibliographic entry see Field 02B.
W69-08907

SEISMIC INVESTIGATION OF ICE PROPERTIES AND BEDROCK TOPOGRAPHY AT THE CONFLUENCE OF TWO GLACIERS, KASKAWULSH GLACIER, YUKON TERRITORY, CANADA,
Ohio State Univ. Research Foundation, Columbus. Inst. of Polar Studies.
Gilbert Dewart.
Ohio State Univ Inst of Polar Studies Rep No 27, Sept 1968. 207 p, 40 fig, 8 tab, 149 ref.

Descriptors: *Ice, *Glaciers, *Bedrock, *Topography, Heat balance, Energy, Seismic studies, Anisotropy, Valleys, Winds, Air temperature, Crystallography, Geology, Climates, Physical properties, Fissures (Geology), Structural analysis.
Identifiers: *Canada, Kaskawulsh Glacier, Yukon Territory.

The purpose of this study was (1) to investigate seismic velocity inhomogeneity and anisotropy in strongly deformed glacier ice; and (2) to determine the form and dimensions of that part of a sub-glacial valley where 2 large temperate glaciers merge. Noise detecting seismographs, boreholes, geological studies, and refraction and reflection seismic surveys were utilized in the area. The seismic noise in the glacier area is due to wind action, and the mean P-wave and S-wave velocities in the glacier at depths 10-100 m are 3.63 km and 1.74 km/sec, respectively. From 10 m depth to the surface the velocities of P- and S-waves decrease markedly to 3.0 km/sec and 1.5 km/sec, respectively. It is concluded that velocity anisotropy is due to ice crystal orientation, foliation structure of alternating ice layers, and crystallographic features. The greatest depth of ice in the Central Arm is about 1000 m, and both arms of the glacier are roughly parabolic in cross-section. (Gabriel-USGS)
W69-08924

A MEASURE OF THE SNOW PRECIPITATION (FRENCH),
Alpine Glaciology Lab., Grenoble (France).
For primary bibliographic entry see Field 02B.
W69-08930

RECESSION OF PERMAFROST IN A CULTIVATED SOIL OF INTERIOR ALASKA,
Alaska Agricultural Experiment Station, Palmer; and Soil Conservation Service, Palmer, Alaska.
For primary bibliographic entry see Field 02G.
W69-08936

FORMATION AND REDUCTION OF ICE FOG,
Army Terrestrial Sciences Center, Hanover, N.H.
For primary bibliographic entry see Field 02B.
W69-08961

2D. Evaporation and Transpiration

SOIL MOISTURE DEPLETION PATTERNS AROUND SCATTERED TREES,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
For primary bibliographic entry see Field 02G.
W69-08665

INCREASING WATER YIELD FROM FOREST, CHAPARRAL, AND DESERT SHRUB IN ARIZONA,
For primary bibliographic entry see Field 03B.
W69-08685

STRUCTURE OF THE WATER BALANCE OF BODIES OF WATER,
Ministry of Melioration and Water Resources Management (USSR).
N. M. Kurganova.
Soviet Hydrol: Selec Pap, Issue No 2, p 150-153, 1968. 4 p, 1 fig, 2 tab, 3 ref.

Descriptors: *Water balance, *Hydrologic budget, *Reservoir design, *Statistical methods, Correlation analysis, Inflow, Evaporation, Streamflow, Precipitation (Atmospheric).
Identifiers: *USSR, Reservoir water balance.

Lake and reservoir water balances in the USSR are compared statistically. Surface area, catchment area, precipitation, inflow, evaporation, and outflow data are tabulated. The ratio of catchment area to water surface area is related to the effects of the elements of the water balance; as the ratio decreases, precipitation plays an increasing role and the evaporation role increases. The relations are shown by graphs and may be used in reservoir planning and design. (Knapp-USGS)
W69-08729

ABOUT THE PROBLEM OF THE DETERMINATION OF SHORT-PERIOD EVAPORATION AMOUNTS,
Meteorologischer Dienst der Deutschen Demokratischen Republic, Berlin. Forschungsinstitut fuer Hydrometeorologie.
D. Richter.
Symp on Geochem, Precipitation, Evaporation, Soil-Moisture, Hydrom, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 78, p 293-299, 1968. 7 p, 4 fig, 1 tab, 6 ref.

Descriptors: *Evaporation, *Reservoir evaporation, Mathematical models, Evaporation pans, Water balance, Temperature, Hydrologic budget, Heat budget, Winds, Energy budget.
Identifiers: *Germany, Lake Stechlin (Germany).

Numerous recent investigations on the evaporation of free water surfaces yield remarkable improvement of the knowledge about this water budget parameter. At present monthly values may easily be assessed by several methods, accurate enough for operational requirements. However, a major problem is the determination of short-period evaporation. The basic theoretical concepts were obtained by recent studies of the exchange processes in the near-ground layer of air. The measuring technique is improved by the development of eddy flux evaporation measurements. In the present study the attempt was made to use theoretical formulas and measuring techniques to obtain diurnal and hourly values of the evaporation from a free water surface without employing empirical relations and constants. To test the theory, an investigation was made on Lake Stechlin, Germany with a wind-velocity gradient measuring unit, psychrometers, and water temperature thermometers. Calculated evaporation averages less than measured evaporation, and agreed well with data showing that evaporation-pan measurements are usually too high. (Knapp-USGS)
W69-08927

EVAPOTRANSPIRATION FROM TWO PEATLAND WATERSHEDS,
Forest Service (USDA), Grand Rapids, Minn. North Central Forest Experimental Station.
Roger R. Bay.
Symp on Geochem, Precipitation, Evaporation, Soil-Moisture, Hydrom, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Publ No 78, p 300-307, 1968. 8 p, 1 fig, 4 tab, 14 ref.

Descriptors: *Evapotranspiration, *Bogs, *Minnesota, Water balance, Energy budget, Small watersheds, Lakes, Humid climates, Runoff, Rainfall-runoff relationships.
Identifiers: Thornthwaite method.

Measurements of precipitation runoff, and bog water table levels provided data for the calculation of evapotranspiration from 2 forested peatland watersheds near Grand Rapids, Minnesota. Continuous hydrologic records were collected on 1 experimental bog for 6 yr (1961-1966) and on the other for the past 2 yr (1965-1966). Water level changes in each bog were converted to inches-depth of storage by water yield coefficients for specific peat horizons and used to adjust precipitation-runoff calculations. Evapotranspiration estimates for the growing-season period May 1 to November 1 ranged from 87 to 121% of potential evapotranspiration computed by the Thornthwaite method. Midsummer evapotranspiration totals (June 1 to Sept 1) were 70 to 99% of potential evapotranspiration. Mean daily evapotranspiration values from both bogs during short summer drying periods were consistently less than the calculated potential values. (Knapp-USGS)
W69-08933

SOIL WATER EVAPORATION: SURFACE RESIDUE RATE AND PLACEMENT EFFECTS,
Agricultural Research Service, Mandan, N. Dak. Northern Plains Branch.
J. J. Bond, and W. O. Willis.
Soil Sci Soc Amer Proc, Vol 33, No 3, p 445-448, May-June 1969. 4 p, 4 fig, 15 ref.

Descriptors: *Evaporation, *Evaporation control, *Soil moisture, *Stubble mulching, Water conservation, Water management (Applied), Laboratory tests, Water yield improvement, Mulching.
Identifiers: *Evaporimeters.

Evaporation rates were measured in columns of originally wetted fine sandy loam soil subjected to uniform daily evaporative potential and treated with various rates of surface residue. During the initial constant-rate drying stage, evaporation decreased with increasing residue rates. Conjunctively, the period of constant rate drying was appreciably lengthened with decreasing evaporation rates. After prolonged falling rate drying, cumulative evaporative losses were nearly equal irrespective of surface residue. It was hypothesized that during falling-rate, drying and with limited quantities of residue, total evaporation might be less if the residue were placed on less than the entire soil surface in concentrated zones. Utilizing the available data, calculated curves were constructed which supported the hypothesis. (Knapp-USGS)
W69-08953

2E. Streamflow and Runoff

STREAM LENGTHS AND BASIN AREAS IN TOPOLOGICALLY RANDOM CHANNEL NETWORKS,
California Univ., Los Angeles.
Ronald L. Shreve.
J Geol, Vol 77, No 4, p 397-414, July 1969. 18 p, 16 fig, 2 tab, 20 ref.

Descriptors: *Geomorphology, *Drainage density, *Drainage patterns (Geologic), *Statistical methods, *Probability, Streams, Drainage systems, Tributaries, Networks, Statistical models, Mathematical models.
Identifiers: Drainage basin topology, Stream order, Stream length, Topology.

The topological properties of random channel networks are examined to clarify the relationships of stream lengths, stream orders, and basin areas. In finite topologically random channel networks with specified stream numbers, the expected number of links per stream and per subnetwork of given order are given by closed but complicated formulas, from which the expected stream lengths and Schumm lengths can be calculated. As observed in natural networks, in a topologically random population, (1) the expected stream lengths do not satisfy Horton's geometric-series law as well as the expected stream numbers, whereas the expected Schumm lengths do, (2) on Horton diagrams the curves are straightest for the most probable networks of order lower or higher, respectively, than the most probable, and (3) the geometric-mean stream-length and Schumm-length ratios are about 2 and 4.5, respectively. The corresponding results for basin areas are exactly the same as for Schumm lengths. In the Perth Amboy basin studied by Schumm, the average area draining directly overland into unit length of channel is not a constant independent of the particular position of the channel in the basin as he proposed, but is less for exterior links than for interior links. Substantial differences in the relative areas draining into sources and in other geomorphic characteristics are not reflected in Horton diagrams because the Horton variables are averages that are mainly determined by network topology. Of most fundamental significance, therefore, are not the Horton variables, but the more elementary quantities, such as link lengths and source areas. (Knapp-USGS)
W69-08697

CREST-STAGE GAGING STATIONS IN OREGON,
Geological Survey, Portland, Oreg.
John Friday.
Geol Surv Open-file Rep, Apr 1969. 90 p, 6 fig, index.

Descriptors: *Data collections, *Stream gages, *Oregon, Stage-discharge relations, Streamflow, Runoff, Flow measurement, Water levels.
Identifiers: *Crest-gage stations.

Crest-stage gage data compiled in Oregon from Oct 1952 to Sept 1968 are presented. Each record consists of a brief description of the location and physical features of the gage site, and a table of peak data collected in the period of record. Basin characteristics are given if they have been evaluated. (Knapp-USGS)
W69-08704

WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF ENGINEERS IN NEW JERSEY.
Corps of Engineers, New York. North Atlantic Div.
For primary bibliographic entry see Field 08A.
W69-08710

WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF ENGINEERS IN ALASKA, 1969.
Corps of Engineers, Portland, Oreg. North Pacific Div.
For primary bibliographic entry see Field 08A.
W69-08718

FLOOD PLAIN INFORMATION, NEOSHO RIVER AND TAR CREEK, MIAMI, OKLAHOMA.
Corps of Engineers, Tulsa, Okla.

Corps Eng Flood Plain Rep, June 1969. 49 p, 8 fig, 23 plate, 14 tab. Prepared for the city of Miami.

Descriptors: *Floods, *Flood damage, *Oklahoma, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Miami (Okla), Neosho River, Standard project flood, Intermediate regional flood.

Flooding of the Neosho River and Tar Creek, Miami, Oklahoma is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-08719

FLOOD PLAIN INFORMATION, RIO GRANDE, MONTE VISTA, COLORADO.
Corps of Engineers, Albuquerque, N. Mex.

Corps Eng Flood Plain Rep, June 1969. 40 p, 8 fig, 15 plate, 11 tab. Prepared for the city of Monte Vista.

Descriptors: *Floods, *Flood damage, *Rio Grande, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Monte Vista (Colo), Standard project flood, Intermediate regional flood.

Flooding of the Rio Grande, Monte Vista, Colorado is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-08720

FLOOD PLAIN INFORMATION, DRY CREEK, CHEYENNE, WYOMING - VOLUME 1,
Corps of Engineers, Omaha, Nebr.

Corps Eng Flood Plain Rep, Apr 1969. 23 p, 6 plate, 6 photo, 4 tab. Prepared for the city of Cheyenne.

Descriptors: *Floods, *Flood damage, *Wyoming, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Cheyenne (Wyo), Standard project flood, Intermediate regional flood.

Flooding of Dry Creek, Cheyenne, Wyoming is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-08721

METHODS OF ESTIMATING MAXIMUM DISCHARGE OF GIVEN PROBABILITY,
Ministry of Melioration and Water Resources Management (USSR).
I. Ye. Kuksin.
Soviet Hydrol: Selec Pap, Issue No 2, p 157-160, 1968. 4 p, 2 tab, 8 ref.

Descriptors: *Flood forecasting, *Streamflow forecasting, *Statistical methods, Hydrograph analysis, Maximum probable flood, Probability, Frequency analysis, Estimating.
Identifiers: USSR, Gumbel method.

Methods are given for estimating the probabilities of given discharges from streamflow data. The most commonly used methods are interpretations of data plotted on various distribution curves. The gamma-distribution or binomial curve and the 3-parameter gamma distribution are commonly used in the USSR, and the log-normal curve, binomial curve, and the Fisher-Tippet curve are used elsewhere. Flood data from 3 gaging stations were used to test the methods of interpreting distribution curves. The most efficient method of estimating discharge probability, both theoretically and practically, was using the method of maximum likelihood and the binomial curve. The method of quantiles estimates maximum discharges better than the method of moments. The best estimates are by Gumbel's methods based on a theory of the extreme terms of a sample. (Knapp-USGS)
W69-08724

STATISTICAL METHOD OF DETERMINING THE OPTIMUM NUMBER OF MEASUREMENTS OF STREAMFLOW CHARACTERISTICS,
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 07A.
W69-08728

SUBSURFACE FEEDING OF RIVERS IN THE NEMAN BASIN,
Ministry of Melioration and Water Resources Management (USSR).
V. V. Drozd.
Soviet Hydrol: Selec Pap, Issue No 2, p 153-157, 1968. 5 p, 3 tab, 12 ref.

Descriptors: *Base flow, *Rivers, *Groundwater basins, Groundwater movement, Hydrograph analysis, Statistical methods, Correlation analysis, Surface-groundwater relationships, Streamflow, Data collections.
Identifiers: *USSR.

The groundwater flow into the rivers of the Neman Basin, USSR is described. The major aquifers drained by streams are alluvial gravels and glacial valley-fill deposits. Data collected for 15-20 yr were analyzed statistically and are tabulated. (Knapp-USGS)
W69-08730

THICKNESS CHARACTERISTICS OF ICE ON THE PRIPYAT' RIVER,
Ministry of Melioration and Water Resources Management (USSR).
For primary bibliographic entry see Field 02C.
W69-08733

LIMITING MAXIMUM DISCHARGES IN LIT/SEC/SQ KM OF THE EARTH'S RIVERS AND THE METHODS FOR THEIR DETERMINATION (RUSSIAN),
State Hydrological Inst., Leningrad (USSR).
D. L. Sokolovskiy.
Trudy Gos Gidrol Inst, No 163, p 3-8, 1968. 6 p, 1 tab, 9 ref.

Descriptors: *Discharge (Water), *Runoff, *Earth (Planet), *Rivers, Floods, Winter, Summer, Mathematical models, Meteorological data, Hydrologic data, Snowmelt, Statistical methods, Rain, Slopes, Heat balance.
Identifiers: Rain runoff.

Maximum rain runoff of the earth was investigated analytically and experimentally using maximal daily precipitation versus maximal rain runoff recorded in the USSR, Mediterranean Countries, North and South America, and Asia. A formula is proposed in which maximum elemental discharge is less than or equal to the product of water-supply intensity and empirical runoff, infiltration, and evapotranspiration coefficients. The maximum discharges computed by using the meteorological and hydrometrical data give similar values, in spite

of the errors involved in the recording of these data. (GabrielaUSGS)
W69-08736

REDUCTION OF A RIVER RUNOFF SERIES TO A LONG-TERM PERIOD BY USING A METHOD OF MULTILINEAR CORRELATION (RUSSIAN),
State Hydrological Inst., Leningrad (USSR).
A. V. Rozhdestvenskiy, and A. G. Lobanova.
Trudy Gos Gidrol Inst, No 163, p 9-18, 1968. 10 p, 3 fig, 2 tab, 7 ref.

Descriptors: *Rivers, *Runoff, *Mathematical models, *Correlation analysis, Analog models, Hydrologic data, Gaging stations, Least squares method, Reliability, Electronic equipment.
Identifiers: *USSR, Svir', Neva, Vuoksa, Belaya, and Chusovaya Rivers.

The runoffs of Svir', Neva, Vuoksa, Belaya and Chusovaya Rivers were analyzed by using a method of multilinear correlation. The method is based on the numerical determination of the coefficients of regression expressed by a linear equation connecting the observed runoffs with those at the analogous points. The regression coefficients can be determined by using a technique developed by V. I. Romanovskiy (1938). The computed regression coefficients were applied to the long-term river discharge data. The reduction of a river runoff series to a long-term period, especially by using an electronic computer, can be considered as a dependable method. (Gabriel-USGS)
W69-08737

MATHEMATICAL MODELS FOR THE DISPERSION OF RADIONUCLIDES IN AQUATIC SYSTEMS,
Texas Univ., Austin. Environmental Health Engineering Research Lab.
Neal E. Armstrong, and Earnest F. Gloyna.
Available from CFSTI as CONF 670503. Proc 2nd Nat Symp on Radioecology, CONF 675030, May 15-17, 1967, Ann Arbor, Mich, p 329-335, Mar 1969. 7 p, 4 fig, 23 ref.

Descriptors: *Dispersion, *Radioisotopes, *Surface waters, *Water pollution effects, *Mathematical models, Equations, Diffusion, Sorption, Hydraulic models.
Identifiers: Radioisotope dispersion.

A general equation is presented which describes radionuclide transport in terms of hydraulic dispersion and convection and by detention systems which sorb and release. A model describes sorption by various substrates using the concentration gradient between the equilibrium activity in the substrate and the actual activity. Linear equations allow an easy solution, while the non-linear form permits ready comparison of sorption mechanisms between systems. (See also Vol 2, No 18, 05C, W69-07441). (Knapp-USGS)
W69-08739

MEASUREMENTS OF BACKGROUND RADIATION IN AQUATIC HABITATS IN ALASKA,
Dartmouth Coll., Hanover, N. H. Dept of Biological Sciences; and Army Terrestrial Sciences Center, N.H.
G. E. Likens, and P. L. Johnson.
Available from CFSTI as CONF 670503. Proc 2nd Nat Symp on Radioecology Conf 670503, May 15-17, 1967, Ann Arbor, Mich, 319-328, Mar 1969. 10 p, 3 fig, 2 tab, 21 ref.

Descriptors: *Radioactivity, *Surface waters, *Alaska, *Background radiation, Lakes, Ponds, Streams, Sediments, Provenance, Radioecology, Arctic, Tundra.
Identifiers: Natural radioactivity.

Measurements of ionizing radiation, made during 1965 in 9 lakes, 3 rivers, 1 hot springs area and adjacent terrestrial substrates in Alaska, indicated that the background radiation in these habitats varied greatly. The lakes were characterized by a small amount of ionizing radiation at mid-depths and increasing quantities near the air and sediment boundaries. Moreover, the radioactivity of the sediments near shore was up to 3.2 times as high as the sediment values near the center. This pattern of background radiation has been relatively consistent in natural lakes of diverse geographic areas; hence, a model for background radiation in freshwater lakes is proposed. Variations in this model were a function of local differences in geologic substrates and input of allochthonous materials. The radioactivity from sediments in ponds of the Arctic tundra was due to naturally occurring radionuclides. (See also VOL 2, No 18, 05C, W69-07441). (Knapp-USGS)
W69-08740

WATER RESOURCES OF THE SCHUYLKILL RIVER BASIN,
Geological Survey, Harrisburg, Pa.
J. E. Biesecker, J. B. Lescinsky, and C. R. Wood.
Penn Dep Forests and Waters, Water Resources Bull No 3, May 1968. 198 p, 74 fig, 68 tab, 95 ref, 1 append.

Descriptors: *Water resources, *Water utilization, *Surface waters, *Groundwater, *Pennsylvania, Water quality, Water sources, Streamflow, Groundwater basins, Municipal water, Industrial water, Water levels, Water pollution, Acid mine water, Silting, Water pollution control, Sediment load, Data collections, Hydrologic data.
Identifiers: Schuylkill River (Penn), Philadelphia.

The water resources of the Schuylkill River Basin, Pennsylvania are evaluated by a comprehensive study of groundwater and surface water quantity, quality, and use. Special attention is given to the effects of coal mining, urbanization, and the effects of restoration and water pollution control of the Schuylkill River. In many parts of the basin, human activities are the most important hydrologic factor. Coal mining affects both groundwater and surface water quality in the headwaters and affects the quality of the entire main stem of the river. Reservoir regulation affects the flow of several tributaries. Philadelphia diverts up to 91% of the streamflow of the Schuylkill for public supply. Pumping is lowering groundwater levels in many areas. Mean annual runoff is 21.5 inches, or 48% of the annual precipitation of 44.7 inches. The population of the basin is 1.47 million, 91% served by public supply. The water problems of the basin result mainly from inadequate municipal water systems and degradation of sources by pollution. (Knapp-USGS)
W69-08744

SEDIMENT DATA FOR CANADIAN RIVERS-1966.
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.
For primary bibliographic entry see Field 02J.
W69-08746

WATER RESOURCES DATA FOR TEXAS, 1968-PART 1. SURFACE WATER RECORDS.
Geological Survey, Austin, Tex.

Geol Surv Basic Data Duplicated Rep, 1969. 591 p, 1 fig, index.

Descriptors: *Data collections, *Surface waters, *Streamflow, *Texas, Stream gages, Lakes, Reservoirs, Stage-discharge relations, Water supply.
Identifiers: *Surface water records, Water resources data.

The surface-water records for the 1968 water year for gaging stations, partial-record stations, and miscellaneous sites in Texas are presented. The data generally comprise a description of the station and a table showing the daily discharge and monthly and yearly discharge of the stream. The description of the station gives the location, drainage area, records available, type and history of gages, average discharge, extremes of discharge, and general remarks. The type of gage currently in use and the datum of the gage above mean sea level, and a condensed history of the types, locations, and datums of previous gages used during the period of records available are listed. Information on the accuracy of the records and conditions which affect the natural flow is given under 'Remarks.' Daily discharges, average discharge, extremes, yearly totals, and peak discharges are listed in table. (Knapp-USGS)
W69-08758

WATER RESOURCES DATA FOR NORTH CAROLINA, 1968-PART 1. SURFACE WATER RECORDS.
Geological Survey, Raleigh, N.C.

Geol Surv Basic Data Duplicated Rep, 1969. 242 p, 2 fig, index.

Descriptors: *Data collections, *Surface waters, *Streamflow, *North Carolina, Stream gages, Lakes, Reservoirs, Stage-discharge relations, Water supply.
Identifiers: *Surface water records, Water resources data.

The surface-water records for the 1968 water year for gaging stations, partial-record stations, and miscellaneous sites in North Carolina are presented. The data generally comprise a description of the station and a table showing the daily discharge and monthly and yearly discharge of the stream. The description of the station gives the location, drainage area, records available, type and history of gages, average discharge, extremes of discharge, and general remarks. The type of gage currently in use and the datum of the gage above mean sea level, and a condensed history of the types, locations, and datums of previous gages used during the period of records available are listed. Information on the accuracy of the records and conditions which affect the natural flow is given under 'Remarks.' Daily discharges, average discharge, extremes, yearly totals, and peak discharges are listed in a table. (Knapp-USGS)
W69-08759

HYDROLOGIC CONDITIONS DURING 1966 IN DADE COUNTY, FLORIDA,
Geological Survey, Tallahassee, Fla.
John E. Hull, and Claiborne F. Galliher.
Geol Surv Open-file Rep, Dec 1968. 41 p, 36 fig, 4 tab, 7 ref.

Descriptors: *Data collections, *Hydrologic data, *Florida, Water levels, Water wells, Aquifers, Runoff, Streamflow, Rainfall, Hydrographs, Water-level fluctuations, Discharge (Water), Water yield, Canals, Drainage, Recharge.
Identifiers: *Dade County (Fla).

Hydrologic conditions of Dade County, Florida in 1966 are described in an information report consisting of tables, maps, graphs, and explanatory text. Water levels, stream and groundwater discharge, and rainfall data were obtained from an extensive network of observation wells, stream-gaging stations, and rainfall stations. (Knapp-USGS)
W69-08762

HARMONIC ANALYSIS OF THE MOUNTAIN RIVER HYDROGRAPH (RUSSIAN),
Tadzhikskii Selsko Khoziaistvennyi Institut, Dushanbe (USSR).
V. N. Suschevskiy, and F. T. Kozlov.
Dokl Akad Nauk Tadzh, SST, Vol 11, No 9, p 56-58, 1968. 3 p, 1 fig, 6 ref.

Descriptors: *Hydrograph analysis, *Rivers, *Streamflow, *Mathematical studies, Fourier analysis, Runoff, Discharge (Water), Highwater level, Correlation analysis, Floods, Low water mark.

Identifiers: *USSR, Shakh-Dara River, Tadzhikistan.

Discharge data for 1947, 1948, and 1958 of the Shakh-Dara River Tadzhikistan, were analyzed by using the Fourier series with the mean monthly and annual river discharges expressed in cu m/sec. It was assumed, on the basis of V. L. Shul'ts' investigations of the Central Asia Rivers (1956), that the coefficients of the Fourier series are a function of the mean annual discharges and the hydrologic data of Shakh-Dara can be quite satisfactorily expressed by using the first 3 terms of the series. The procedure of the harmonic analysis consists of the calculation of the mean annual discharge of given frequency and then of the calculation of the Fourier series coefficients. By substituting the calculated parameters into the Fourier series, the mean monthly discharges can be readily evaluated. (Gabriel-USGS)
W69-08773

TECHNIQUE FOR LONG RANGE PREDICTION OF STREAM FLOW,
Clemson Univ., S.C.
Richard M. Greening, and Albert G. Law.
Clemson Univ Water Resources Research Institute, Rept No 10, May 1969. 95 p, 6 tab, 18 fig, 28 ref, 3 append. OWRR Project A-010-SC.

Descriptors: Runoff, *Streamflow, Surface waters, Water supply, *River forecasting, Hydrologic models, *Streamflow forecasting.

The problem of predicting streamflow for an extended period has received very little attention. The work that has been done on this problem is largely confined to the prediction of seasonal or annual flow volumes from snow melt by use of multiple correlation techniques. The period selected for prediction was one month, since this is believed to be an operationally useful time unit for potential users of the forecast product. The major factors affecting the streamflow for the next month are believed to be three in number. These are carry-over of flow from antecedent groundwater flow and surface runoff and runoff resulting from precipitation occurring during the month to be forecast. A procedure was devised to reflect each of these factors. The river basin selected for testing the forecast technique was the drainage area of the Oconee River near Greensboro, Georgia. The technique was developed using three years of observed data and then tested using two years of independent data. Median discharge and an adjusted median discharge were used as a standard to test the validity of the prediction technique. (Law-Clemson)
W69-08888

TALACHAY RIVER MUD FLOW OF AUGUST 19, 1964 (RUSSIAN),
Akademiya Nauk SSSR.
S. A. Akhundov.
Izv Akad Nauk, Azergaidzh, SSR, No 6, p 97-103, 1968. 7 p, 4 fig, 7 ref.

Descriptors: *Mudflows, *Streamflow, *Rivers, Flood damage, Dams, Bridge failure, Crops, Cities, Hydrologic properties, River basins, Watersheds (Divides), Altitude, Slopes, Seasonal, Discharge (Water), Altitude, Air circulation, Currents (Water).
Identifiers: *USSR, *Talachay River.

The article describes in detail the hydrological characteristics and the damage done by a mudflow of August 19, 1964 of the Talachay River located in the greater Caucasus Mountains, USSR. The mudflow consisted mainly of gravel and pebble material occassionally containing some large boulders; however, the river water samples contained 70-90 kg/cu m of silt during the mudflow duration. The mudflow lasted about 7 hr with the maximum discharge of 265 cu m/sec at the Meshlesh Village and of 60 and 40 cu m/sec respectively, on the Thil'banchay and Bakhmazchay streams, tributaries of the Talachay River. (Gabriel-USGS)
W69-08900

HYDROLOGICAL YEAR-BOOK OF ISRAEL 1966-67.
Ministry of Agriculture, Jerusalem (Israel). Hydrological Service.

Israel Hydrol Serv Year-book, Jerusalem, 1969. 155 p.

Descriptors: *Hydrologic data, *Streamflow, *Groundwater, *Water levels, *Water quality, Data collections, Hydrographs, Peak discharge, Low flow, Surface waters, Gaging stations, Aquifers, Springs, Lakes, Saline lakes.
Identifiers: *Israel, *Periodic observations.

Hydrological and chemical data for gaging stations of rivers, wadis, springs, and lakes for the period Oct 1966 to Sept 1967 are presented. Groundwater data are summarized in a map showing water levels and salinity contours in the aquifers in the Coastal Plain and Foothills Area in autumn 1967. The 1966-67 precipitation and runoff were slightly below the 10-yr average at all stations. (Knapp-USGS)
W69-08908

PRELIMINARY TIDAL FLOOD INFORMATION FOR THE COASTAL AREA OF CHATHAM COUNTY, GEORGIA.
Corps of Engineers, Savannah, Ga.

Corps Eng Flood Plain Rep, Dec 1968. 21 p, 6 plate, 7 tab.

Descriptors: *Floods, *Flood damage, *Georgia, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Shores, Tides, Erosion, Beach erosion, Historic flood.
Identifiers: Chatham County (Ga), Standard project flood, Intermediate regional flood.

Flooding of the coastal area of Chatham County, Georgia is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-08909

FLOOD PLAIN INFORMATION, COLUMBIA RIVER AND TRIBUTARIES, COWLITZ COUNTY, WASHINGTON.
Corps of Engineers, Portland, Oreg.

Corps Eng Flood Plain Rep, Jan 1969. 83 p, 8 fig, 46 plate, 29 tab. Prepared for Cowlitz County, Wash.

Descriptors: *Floods, *Columbia River, *Flood damage, *Washington, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Cowlitz County (Wash), Standard project flood, Intermediate regional flood.

Flooding of the Columbia River, Cowlitz County, Washington is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-08910

FLOOD PLAIN INFORMATION, LAGUNA CANYON, ORANGE COUNTY FLOOD CONTROL DISTRICT.
Corps of Engineers, Los Angeles, Calif.

Corps Eng Flood Plain Rep, Mar 1969. 31 p, 18 fig, 24 plate, 5 tab. Prepared for Orange County Flood Control District.

Descriptors: *Floods, *Flood damage, *California, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Orange County (Calif), Standard project flood, Intermediate regional flood.

Flooding of Laguna Canyon, Orange County, California is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-08911

RADIOACTIVE TRACERS IN HYDROLOGICAL RESEARCHES IN USSR,
Moscow State Univ. (USSR).
S. J. Vartazarov, N. I. Ilyin, N. J. Flexer, and A. I. Jakovlev.
Symp on Geochem, Precipitation, Evaporation, Soil-Moisture, Hydrom, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 78, p 156-161, 1968. 6 p, 2 fig, 22 ref.

Descriptors: *Tracers, *Radioisotopes, Groundwater movement, Currents (Water), Streamflow, Sedimentation, Bed load, Suspended load, Tracking techniques.
Identifiers: *USSR.

The use of radioactive tracers in hydrological work in the USSR is outlined. Tracer experiments in groundwater flow, riverflow, sea currents, and sedimentary processes are briefly described. Some formulas and equations used in Soviet tracer experiments are listed and explained. (Knapp-USGS)
W69-08913

THE EFFECT OF MINGECHAUR RESERVOIR ON THE THERMAL REGIME OF THE LOWER REACHES OF KURA RIVER (RUSSIAN),
Akademiya Nauk SSSR.
R. B. Tarverdiyev.
Izv Akad Nauk, Azerbaidzh. SSR, No 1, p 49-55, 1969. 7 p, 6 fig, 3 tab, 2 ref.

Descriptors: *Reservoirs, *Thermal water, *Rivers, *River basins, *Water temperature, Seasonal, Winter, Hydroelectric plants, Autumn, Spring, Summer, Estuaries, Discharge (Water), Fish harvest, Irrigation efficiency.
Identifiers: Kura River, Transcaucasia, USSR.

The effect of the Mingechaur Reservoir on the thermal regime of the Kura River was investigated on the basis of temperature information collected at 14 stations on the river since 1930. Considerable change in water temperature has occurred since construction of the Mingechaur Reservoir. The change occurred during 2 periods: (1) autumn-winter period, characterized by a temperature increase of+6.0 deg at Mingechaur,+8.0 deg at Yevlakh,+3.5 deg at Zardob,+1.3 deg at Alibayramlov, and+1.1 deg in the estuary; and (2) spring-summer period characterized by a temperature decrease of -4.6 deg at Mingechaur, -5.8 deg at Yevlakh, -3.6 deg at Zardob, -1.4 deg at Alibayramlov, and -0.9 deg in the estuary. These changes in thermal regime of the Kura River may affect the fishing industry and irrigation possibilities. (Gabriel-USGS)
W69-08925

FLOOD PLAIN INFORMATION, WALNUT CREEK, CITY OF MACON AND BIBB COUNTY, GEORGIA.
Corps of Engineers, Savannah, Ga.

Prepared for the city of Macon and Bibb County, Georgia. Corps Eng Flood Plain Rep, Dec 1968. 42 p, 12 fig, 15 plate, 14 tab.

Descriptors: *Floods, *Flood damage, *Georgia, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Macon, Bibb County (Ga.), Standard project flood, Intermediate regional flood.

Flooding of Walnut Creek, Macon and Bibb County, Georgia is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-08934

SURFACE WATER DATA REFERENCE INDEX OF ALBERTA-1968.
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.

Inland Waters Br Water Surv of Canada Basic Data Rep, 1969. 53 p, 2 map, 1 tab, 2 index.

Descriptors: *Surface waters, *Stream gages, *Gaging stations, Data collections, Hydrologic data, Streamflow, Water levels.
Identifiers: *Canada, Alberta.

Surface water stations in Alberta, Canada are listed. Station identification number, name, drainage area, gage location availability of discharge records, type of gage, operation, recorder type, and remarks are tabulated. Station locations are shown by maps. (Knapp-USGS)
W69-08941

SURFACE WATER DATA REFERENCE INDEX OF YUKON TERRITORY AND NORTHWEST TERRITORIES-1968.
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.

Inland Waters Br Water Surv of Canada Basic Data Rep, 1969. 13 p, 2 map, 2 tab, 2 index.

Descriptors: *Surface waters, *Stream gages, *Gaging stations, Data collections, Hydrologic data, Streamflow, Water levels.
Identifiers: *Canada, Yukon Territory, Northwest Territories.

Surface water stations in Yukon and Northwest Territories, Canada are listed. Station identification number, name, drainage area, gage location, availability of discharge records, type of gage, operation, recorder types, and remarks are tabulated. Station locations are shown by maps. (Knapp-USGS)
W69-08944

SURFACE WATER DATA REFERENCE INDEX OF ONTARIO-1968.
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.

Inland Waters Br Water Surv of Canada Basic Data Rep, 1969. 42 p, 2 map, 1 tab, 2 index.

Descriptors: *Surface waters, *Stream gages, *Gaging stations, Data collections, Hydrologic data, Streamflow, Water levels.
Identifiers: *Canada, Ontario.

Surface water stations in Ontario, Canada are listed. Station identification number, name, drainage area, gage location, availability of discharge records, type of gage, operation, recorder type, and remarks are tabulated. Station locations are shown by maps. (Knapp-USGS)
W69-08945

SURFACE WATER DATA REFERENCE INDEX OF SASKATCHEWAN-1968.
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.

Inland Waters Br Water Surv of Canada Basic Data Rep, 1969. 42 p, 2 map, 1 tab, 2 index.

Descriptors: *Surface waters, *Stream gages, *Gaging stations, Data collections, Hydrologic data, Streamflow, Water levels.
Identifiers: *Canada, Saskatchewan.

Surface water stations in Saskatchewan, Canada are listed. Station identification number, name, drainage area, gage location, availability of discharge records, type of gage, operation, recorder type, and remarks are tabulated. Station locations are shown by maps. (Knapp-USGS)
W69-08946

SURFACE WATER DATA REFERENCE INDEX OF ATLANTIC PROVINCES-1968.
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.

Inland Waters Br Water Surv of Canada Basic Data Rep, 1969. 22 p, 2 map, 5 tab, 2 index.

Descriptors: *Surface waters, *Stream gages, *Gaging stations, Data collections, Hydrologic data, Streamflow, Water levels.
Identifiers: *Canada, Atlantic Provinces.

Surface water stations in Atlantic Provinces, Canada are listed. Station identification number, name, drainage area, gage location, availability of discharge records, type of gage, operation, recorder type, and remarks are tabulated. Station locations are shown by maps. (Knapp-USGS)
W69-08947

SURFACE WATER DATA REFERENCE INDEX OF MANITOBA-1968.
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.

Inland Waters Br Water Surv of Canada Basic Data Rep, 1969. 42 p, 2 map, 1 tab, 2 index.

Descriptors: *Surface waters, *Stream gages, *Gaging stations, Data collections, Hydrologic data, Streamflow, Water levels.
Identifiers: *Canada, Manitoba.

Surface water stations in Manitoba, Canada are listed. Station identification number, name, drainage area, gage location, availability of discharge records, type of gage, operation, recorder type, and remarks are tabulated. Station locations are shown by maps. (Knapp-USGS)
W69-08948

SURFACE WATER DATA REFERENCE INDEX OF BRITISH COLUMBIA-1968.
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.

Inland Waters Br Water Surv of Canada Basic Data Rep, 1969. 134 p, 2 map, 1 tab, 2 index.

Descriptors: *Surface waters, *Stream gages, *Gaging stations, Data collections, Hydrologic data, Streamflow, Water levels.
Identifiers: *Canada, British Columbia.

Surface water stations in British Columbia, Canada are listed. Station identification number, name, drainage area, gage location availability of discharge records, type of gage, operation, recorder type, and remarks are tabulated. Station locations are shown by maps. (Knapp-USGS)
W69-08949

SURFACE WATER DATA OF ONTARIO - 1966 WATER YEAR.
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.

Inland Waters Br Water Surv of Canada Basic Data Rep, 1966. 277 p, 2 fig, index.

Descriptors: *Data collections, *Surface waters, *Streamflow, Stream gages, Lakes Reservoirs, Stage-discharge relations.
Identifiers: *Ontario, Canada, Surface water records, Water quality records, Water resources data.

The surface-water records for the 1966 water year for gaging stations, partial-record stations, and miscellaneous sites in Ontario are presented. The data generally comprise a description of the station and a table showing the daily discharge and monthly and yearly discharge of the stream. The description of the station gives the location, drainage area, records available, type and history of gages, average discharge, extremes of discharge, and general remarks. The type of gage currently in use and the datum of the gage above mean sea level, and a condensed history of the types, locations, and datums of previous gages used during the period of records available are listed. Information on the accuracy of the records and conditions which affect the natural flow is given under 'Remarks.' Daily discharges, average discharge, extremes, yearly totals, and peak discharges are listed in a table. (Knapp-USGS)
W69-08954

FLOOD PLAIN INFORMATION, DELAWARE CREEK, IRVING, TEXAS.
Geological Survey, Washington, D.C.

Prepared for the city of Irving, Texas. Corps Eng Flood Plain Rep, May 1969. 37 p, 5 fig, 7 plate, 11 tab.

Descriptors: *Floods, *Flood damage, *Texas, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Irving (Tex), Delaware Creek, Standard project flood, Intermediate regional flood.

Flooding of the Delaware Creek, Irving, Texas is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability of flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-08958

FLOOD PLAIN INFORMATION, ST. JOHNS RIVER, JACKSONVILLE, FLORIDA.
Corps of Engineers, Jacksonville, Fla.

Prepared for consolidated city of Jacksonville. Corps Eng Flood Plain Rep, Mar 1969. 71 p, 10 fig, 18 plate, 20 tab.

Descriptors: *Floods, *Flood damage, *Florida, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: St. Johns River, Jacksonville (Fla), Standard project flood, Intermediate regional flood.

Flooding of the St. Johns River, Jacksonville, Florida is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-08959

2F. Groundwater

THE RESEARCH OF FRESH WATER IN A SALINE ENVIRONMENT,
For primary bibliographic entry see Field 04B.
W69-08686

A GENERAL SUMMARY OF THE STATE OF RESEARCH ON GROUNDWATER HYDROLOGY IN DESERT ENVIRONMENTS,
Arizona Univ., Tucson.
Eugene S. Simpson.
W. G. McGinnies, B. J. Goldman, and Patricia Paylore, Eds., Deserts of the World, an Appraisal of Research into their Physical and Biological Environments, VIII, University of Arizona Press, Tucson, 1967. 18 p, 1 tab, 97 ref.

Descriptors: *Analog models, *Arid lands, *Groundwater, *Evaluation, Hydrology, Aquifers, Artificial recharge management, Geohydrology, Hydrogeology, Groundwater recharge, Water table, Hydrologic budget, Water resources planning, Research and development, Water policy, Data collections, Oynthesis, Subsurface mapping, Water storage.

The author presents a brief histroy of hydrology, an evaluation of the state of knowledge pertaining to groundwater in arid environs, and recommendations on future research needs of sound water policy formation. Sources, accessibility, and reliability of pertinent information are treated. The interrelationship of the objectives of research to those of water policy is stressed as is the need for systematic management of groundwater resources (eg. Israel). Knowledge on aquifers, water budget, and aquifer recharge in arid lands is evaluated in relation to the systems-analysis approach toward solution of water management problems. The author concludes that groundwater hydrology 'is on the threshold of an important period of integration' and it is now necessary and possible to synthesize, to exhibit the functioning system as a whole. Recommendations for future research needs in arid regions include (1) implementation of rational data collection programs in response to modern computer technology, (2) data on hydrogeologic mapping, basic relations between water chemistry and aquifer properties, determination of the distribution of hydraulic head in space and time (suggests development of automatic one year recording gage), (3) evaluation of artificial recharge, this requires a probabilistic description of stream flow for arid regions, (4) greater funding. Includes large annotated bibliography. (Sherbrooke-Ariz)
W69-08688

MEASURING UNDERGROUND-EXPLOSION EFFECTS ON WATER LEVELS IN SURROUNDING AQUIFERS,
Geological Survey, Denver, Colo.
M. S. Garber, and L. E. Wollitz.
Ground Water, Vol 7, No 4, p 3-7, July-Aug 1969. 5 p, 8 fig, 6 ref.

Descriptors: *Water levels, *Groundwater, *Water wells, *Nuclear explosions, *Water level fluctuations, Measurement, Seismic waves, Aquifers, Nevada.
Identifiers: *Nuclear explosion effects.

Underground detonations may produce observable effects in surrounding aquifers and wells. The nature and the duration of the effect at any observation point seem to depend on several factors such as the amount of energy released by the detonation, the geologic environment, the position of the buried explosive device in relation to the saturated zone, aquifer characteristics, and the distance from point of detonation. Precise measurement of these effects in wells presented numerous technical problems and resulted in the development of specialized techniques. Initially, these effects were observed by measuring the fluctuation of the free water surface in wells. The current technique employs high-resolution pressure transducers deep in the water column. Pneumatic packers may be used to restrict the movement of water into the well. Data are recorded on high-speed oscillographs. (Knapp-USGS)
W69-08701

FIELD USE OF ORIFICE METERS,
Geological Survey, Huron, S. Dak.
Donald G. Jorgensen.
Ground Water, Vol 7, No 4, p 8-11, July-Aug 1969. 4 p, 6 fig, 4 ref.

Descriptors: *Discharge (Water), *Measurement, *Flow measurement, *Orifices, Water wells, Discharge measurement, Flow rates, Orifice flow, Outlets, Pipes.
Identifiers: Pump discharge measurement.

A well-designed and calibrated orifice meter is an accurate and inexpensive measuring device for flow. Endline orifices can be calibrated at work sites by solving an equation that interrelates easily measured dimensions of the orifice and outflow. This paper summarizes the development of the discharge equation for circular orifices and describes a procedure for determining the coefficient of discharge under field conditions. (Knapp-USGS)
W69-08702

COMPOSITIONAL SIMILARITIES BETWEEN HOT MINERAL SPRINGS IN THE JORDAN AND SUEZ RIFT VALLEYS,
Israel Atomic Energy Commission, Rehovoth; and Weizmann Inst. of Science, Rehovoth (Israel).
For primary bibliographic entry see Field 02K.
W69-08709

WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF ENGINEERS IN NEW JERSEY.
Corps of Engineers, New York. North Atlantic Div.
For primary bibliographic entry see Field 08A.
W69-08710

VARIATIONS IN FILTRATION VELOCITY DUE TO RANDOM LARGE-SCALE FLUCTUATIONS OF POROSITY,
Moscow Inst. of Mechanical Problems (USSR).
Yu A. Buyevich, A. I. Leonov, and V. M. Safrai.
J Fluid Mech, Vol 37, Part 2, p 371-381, June 23, 1969. 11 p, 12 ref.

Descriptors: *Filtration, *Flow, *Porous media, *Groundwater movement, Porosity, Permeability, Mathematical studies, Turbulence, Laminar flow, Turbulent flow, Unsteady flow, Saturated flow, Diffusion.
Identifiers: Porosity variation, Porosity inhomogeneity.

The local porosity of a real porous material, obtained by averaging over volumes containing a sufficiently large number of pores, is different from the mean porosity of the material as a whole. This difference is caused by large-scale defects of the porous structure and can be treated as a random function of position in the porous material. Such a random deviation of the local porosity from the average value causes random local flows superimposed upon the mean filtration flow. The characteristic scale of such motion is much larger than that of the flow of a fluid through individual pores. The phenomenon appears to play an important role in transport processes in filtranion. The statistical characteristics of the random fields under consideration are determined on the basis of the assumption that the local porosity is a random function of position with independent increments. Expressions for correlati wns of various quantities are obtained in terms of the characteristics of porosity fluctu wtions, and the effective coefficients of diffusion caused by the random motions under study are estimated. (Knapp-USGS)
W69-08716

WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF ENGINEERS IN ALASKA, 1969.
Corps of Engineers, Portland, Oreg. North Pacific Div.
For primary bibliographic entry see Field 08A.
W69-08718

GROUND WATER HYDROLOGY FOR WATER WELL DRILLING CONTRACTORS,
Kent State Univ., Ohio. Dept. of Geology.
Jon L. Rau.
Kent State Univ Dep Geol Textbook Rep, 1968. 259 p, 514 ref.

Descriptors: *Groundwater, *Hydrogeology, *Water wells, Maps, Cross-sections, Stratigraphy, Aquifers, Structural geology, Hydrologic cycle, Artesian wells, Recharge, Water quality, Electrical studies, Surveys, United States.
Identifiers: *Groundwater prospecting, *Textbooks, Aquifer testing.

A textbook for water well drilling contractors presents the basic geologic factors controlling the occurrence, availability, and quality of groundwater. Groundwater hydraulics is not discussed in detail, but important references to it are listed. The hydrogeology of the Eastern United States is covered in better detail than that of other parts of the country. Some of the topics covered in detail are topographic maps, rock terminology, stratigraphic correlation, geomorphology, geologic maps, geologic structure, structural maps, cross sections, the hydrologic cycle, occurrence of groundwater, properties of aquifers, artesian water, induced infiltration, aquifer testing, recharge, groundwater prospecting, well logging, resistivity surveys, water quality, and groundwater in the eastern U.S. physiographic provinces. (Knapp-USGS)
W69-08722

SUBSURFACE FEEDING OF RIVERS IN THE NEMAN BASIN,
Ministry of Melioration and Water Resources Management (USSR).
For primary bibliographic entry see Field 02E.
W69-08730

WATER RESOURCES OF THE SCHUYLKILL RIVER BASIN,
Geological Survey, Harrisburg, Pa.
For primary bibliographic entry see Field 02E.
W69-08744

A LITERATURE SURVEY OF THE USE OF RADIOISOTOPES IN GROUND-WATER STUDIES,
Institute of Geological Sciences, London (England).
J. D. Mather.
Great Brit Inst Geol Sci Tech Commun No 1, 1968. 27 p, 1 fig, 1 tab, 121 ref.

Descriptors: *Groundwater, *Aquifers, *Radioisotopes, Water supply, Radioactive dating, Tritium, Carbon, Silica, Tracers, Porosity, Velocity, Rainfall, Strontium radioisotopes,

Seasonal, Plant physiology, Analytical techniques, Wells.
Identifiers: Radioisotopes in groundwater study.

A detailed survey is presented of the literature on radioactive dating of groundwater. Topics discussed include radioactive dating (tritium, carbon-14, and silicon-32), and radioisotopes as groundwater tracers. Preliminary tracer evaluations are made and field studies described. (Gabriel-USGS)
W69-08745

CAUSES OF FLUCTUATIONS IN THE RATE OF DISCHARGE OF CLEAR LAKE SPRINGS, MILLARD COUNTY, UTAH,
Geological Survey, Washington, D.C.
R. W. Mower.
Geol Surv Water-Supply Pap 1839-E, 1967. 31 p, 8 fig, 1 plate, 2 tab, 12 ref.

Descriptors: *Springs, *Discharge (Water), *Fluctuation, *Utah, Surface-groundwater relationships, Precipitation (Atmospheric), Basalts, Alluvium, Hydrogeology, Groundwater movement, Irrigation wells.
Identifiers: *Pavant Valley, Artesian aquifer.

To determine the relation of the rate of flow of Clear Lake Springs to weather conditions during 1959-1964 and to groundwater withdrawals in Pavant Valley, a hydrologic study was made of the spring area, Millard County, Utah. It was found that seasonal fluctuations in discharge rate of Clear Lake Springs are caused both by variations in the rate of groundwater recharge and by the related variations in the rate of pumping for irrigation in Pavant Valley. Withdrawal of groundwater from wells in the southern four districts causes seasonal reductions in the flow of the springs by reducing the hydraulic gradient between the wells and the springs. Average annual volume of spring discharge was 14,900 acre ft in 1960-1964. Water enters the very permeable basalt aquifer as direct recharge from precipitation, as interformational leakage from a contiguous artesian aquifer in lake and alluvial sediments, and as infiltration of infrequent flood runoff and of unconsumed irrigation water in the valley lowlands. A hydrograph of the spring flow and other data indicate that about 1/5 of the discharged water is from precipitation on the basalt outcrop of the aquifer. (Llaverias-USGS)
W69-08747

HYDROLOGIC CONDITIONS DURING 1966 IN DADE COUNTY, FLORIDA,
Geological Survey, Tallahassee, Fla.
For primary bibliographic entry see Field 02E.
W69-08762

VOLUME OF AQUIFER TESTED FOR PERMEABILITY DURING A ONE-WELL PUMPING TEST,
Sanford I. Strausberg.
Ground Water, Vol 7, No 4, p 24-25, July-Aug 1969. 2 p, 2 fig, 6 ref.

Descriptors: *Groundwater movement, *Water yield, *Permeability, *Water wells, *Aquifers, *Nevada, Artesian wells, Water wells, Hydrogeology, Water levels, Water level fluctuations, Drawdown.
Identifiers: *Aquifer testing, *Pumping tests.

Pumping test data from a single well were used to estimate aquifer volume affecting drawdown. After 4 days of pumping from a 240 ft thick welded tuff aquifer in southern Nevada, the volume of the wedge-shaped mass tested was estimated to be about 15.6 billion cu ft. The field coefficient of permeability of the aquifer is 275 gpd/sq ft. (Knapp-USGS)
W69-08763

METHODS FOR CALCULATING THE COST OF DEVELOPING GROUND-WATER RESOURCES IN APPALACHIA,
Geological Survey, Charleston, W.Va.
Granville G. Wyrick.
Ground Water, Vol 7, No 4, p 21-23, July-Aug 1969. 3 p.

Descriptors: *Water resources development, *Appalachian Mountain Region, *Groundwater, Water wells, Water costs, Economics, Surveys, Reviews, Aquifers.
Identifiers: Appalachia.

The project developed between the U.S. Army Corps of Engineers, Office of Appalachian studies and the U.S. Geological Survey for a study of the groundwater resources in Appalachia had 2 principal objectives. The first objective was to describe in general terms the groundwater resources of the Region as a whole and the second objective was to describe in greater detail the groundwater resources at about 20 selected sites. The methods used to describe the Region as a whole are described with a special emphasis on availability and cost of developing groundwater, as was requested by the Office of Appalachian Studies. (Knapp-USGS)
W69-08764

EFFECTS OF LARGE-SCALE MINING WITHDRAWALS OF GROUND WATER,
North Carolina State Dept. of Water and Air Resources, Raleigh. Div. of Ground Water.
Harry M. Peek.
Ground Water, Vol 7, No 4, p 12-20, July-Aug 1969. 9 p, 8 fig, 7 ref.

Descriptors: *Water levels, *Groundwater, *Mine drainage, *Saline water intrusion, *Aquifers, North Carolina, Water level fluctuations, Artesian wells, Hydrogeology, Recharge, Groundwater movement, Water management (Applied).
Identifiers: Cone of depression.

Expanding water requirements during recent years have intensified development of the productive sedimentary aquifers of the North Carolina Coastal Plain. The effects of this development emphasize the need for an effective management program. Withdrawal of about 60 mgd from the Castle Hayne limestone, the most productive artesian aquifer of the area, began in July 1965 at a phosphate mine adjacent to the Pamlico River in Beaufort County. Within a few months, the artesian head was lowered below sea level in an area of about 800 sq mi, and to more than 100 ft below sea level in the immediate vicinity of pumping. Under these conditions the aquifer became vulnerable to encroachment of saline water from (1) areas of natural occurrence of brackish water in the limestone member of the aquifer; (2) leakage of brackish surface water through the confining beds; and (3) vertical movement of brackish water from the underlying sand member of the aquifer. The dramatic effects of the large withdrawals and the threat of damage to the aquifer created sufficient public concern so that legislation was passed giving the Board of Water and Air Resources authority to regulate groundwater withdrawals as needed. An adequate management program can be accomplished that will not only protect the aquifer but will improve the development potential. The development of such a management program requires a thorough knowledge of the hydrology of the aquifer system, the objective of studies in progress. The implementation of the program will require the support of an informed public. (Knapp-USGS)
W69-08765

THE APPLICATION OF GEOELECTRICAL METHODS TO GROUND-WATER EXPLORATION OF UNCONSOLIDATED METHODS TO GROUND-WATER EXPLORATION OF UNCONSOLIDATED FORMATIONS IN SEMI-ARID AREAS,
Z. Krulc, and M. Mladenovic.
Geoexploration, Vol 7, No 2, p 83-95, June 1969. 13 p, 8 fig, 34 ref.

Descriptors: *Groundwater, *Aquifers, *Electrical studies, *Semiarid climates, Hydrologic properties, Electrical properties, Hydrogeology, Soil physical properties, Structural geology, Salinity, Resistivity, Boreholes, Geology, Alluvium, Limestones, Marl.
Identifiers: *United Arabic Republic (Egypt) and Libya.

The application and interpretation are described of geoelectrical methods utilized in the semiarid areas of Egypt and Libya in exploration for water-bearing formations characterized by their poor consolidation. Geoelectrical methods can be successfully applied in semiarid regions for the solution of several problems as follows: (1) the penetration of saline water into the dry land; (2) the separation of fresh water lenses floating on saline water; (3) the establishment of the depth of water--impermeable basement; and (4) other pertinent problems. These problems can be often successfully solved by the use of resistivity techniques--geoelectrical sounding and geoelectrical profiling. In the geoelectrical sounding method a hydrogeological section is obtained at the observation points as well as the data concerning the depth of single horizons. If exploration boreholes are available, the interpretation of geoelectrical investigations becomes easier, more accurate, and more reliable. (Gabriel-USGS)
W69-08770

INTERPRETATION OF THE RESULTS OF HYDROGEOCHEMICAL PROSPECTING (RUSSIAN),
S. D. Kapranov.
Izv Vysh Ucheb, Geol i Razved, No 4, p 82-87, Apr 1969. 6 p, 3 fig, 6 ref.

Descriptors: *Geochemistry, *Groundwater, *Springs, *Exploration, Water chemistry, Mapping, Sampling, Mineral industry, Trace elements, Organic matter.
Identifiers: *USSR, Sretensk.

The basic principals involved in the interpretation of hydrogeochemical surveys in search for mineralized areas are discussed, and their application is described in a study of the mineralization of springs and groundwaters of Sretensk district, Eastern Transbaikal. The final survey map of mineralization indicators should give the distribution of the following groups: (1) Si, Al, Fe, Ti; (2) Ca, Mg, Na, K, sulfate; (3) Zn, Cu, Mo, As; (4) Li, Rb, Cs, Be; and (5) Cl, F, I, Br, and B. The main problem in interpretation of the hydrochemical results is the identification of some regular connections between the distribution of characteristic elements and hydrochemical zoning of natural waters on one hand and the development of ore-forming processes in the area under study. (Gabriel-USGS)
W69-08771

THE STUDY OF NON-LINEAR FLOW THROUGH POROUS MEDIA BY MEANS OF ELECTRICAL MODELS,
Zagreb Univ. (Yugoslavia).
J. Baturic-Rubcic.
J Hydraul Res, Vol 7, No 1, p 31-65, 1969. 35 p, 12 fig, 13 ref.

Descriptors: *Groundwater flow, *Porous media, Non-uniform flow, *Electric analogs, *Model studies, *Electrical networks, Groundwater, Models, Wells, Artesian wells, *Base flow, Darcy's Law, Filtration, Permeability, Electric potential, Two-dimensional.
Identifiers: *Hydrologic models, Impervious layers, Piezometric head.

A particular network configuration of porous media flow with appropriate electrically nonlinear elements is introduced. Such a network enables investigation on nonlinear and linear flows through porous media by means of an electrical analogy. The network acts very approximately as an isotropic and homogeneous continuous conducting medi-

um with similar properties to a porous medium. A 2-dimensional network is realized. Some typical cases of arbitrarily curvilinear filtration of artesian wells and gravity-flow systems are modeled on this network. For the sake of hydrodynamical interpretation of electrical models, similarity criteria are determined for the considered nonlinear flow, with the aid of which the changes that take place in an original flow system due to transition for linear to filtration nonlinear flow are observed and discussed. (USBR)
W69-08848

A STUDY OF GROUND-WATER RECHARGE FROM THE AKAGI AND HARUNA VOLCANOES, GUMMA PREFECTURE (JAPANESE),
Industrial Science and Technology Agency, Kawasaki (Japan). Geological Survey.
Tsugio Ozaki, and Toshio Kanno.
Bull Geol Surv of Japan, Vol 19, No 6, p 1-19, June 1968. 19 p, 16 fig, 6 tab, 11 ref.

Descriptors: *Groundwater, *Volcanoes, *Groundwater recharge, Geology, Cities, Discharge (Water), Hydrologic properties, Permeability, Water supply, Mapping, Geologic mapping.
Identifiers: *Japan, Akagi and Haruna Volcanoes.

It is usually assumed that a part of groundwater recharge of the aquifers supplying water to the cities of Maebashi and Takasaki depends on the area containing the Agaki and Haruna volcanoes. To check this assumption, the authors decided to obtain pertinent geological and hydrological data and to use a method of specific discharge based on the distribution of geologically uniform units. The study shows that: (1) the fundamental parameters controlling specific discharge depend upon the rock permeability and the conditions of water area; (2) a large quantity of recharge occurs in an area located on the mountain slope; and (3) the amount of recharge and its geographical position may be roughly estimated by using iso-specific discharge contour maps. (Gabriel-USGS)
W69-08894

STUDY OF INDUSTRIAL GROUND-WATER RESOURCES IN THE TSURUGA PLAIN, FUKUI PREFECTURE (JAPANESE),
Industrial Science and Technology Agency, Kawasaki (Japan). Geological Survey.
Shigeru Takahashi, and Hayaji Goto.
Bull Geol Surv of Japan, Vol 19, No 6, p 33-46, June 1968. 14 p, 12 fig, 4 tab, 2 ref.

Descriptors: *Groundwater, *Water resources, *Valleys, Cities, Artesian wells, Water supply, Industrial water, Industrial production, Groundwater recharge, Groundwater movement, Pumping, Water levels, Boreholes, Hydrologic data, Geology, Mapping.
Identifiers: *Japan, Tsuruga City, Fukui Prefecture.

Groundwater resources present in the coastal plain near the Tsuruga City were investigated by using hydrologic and geologic data. The study shows that the Toyoboseki Co. factory is using 60,000 to 70,000 cubic meters of artesian water per day from 20 wells. The study also shows that the recharge source of the artesian water is the streamflows of the Shono-Kawa and Kuro-Kawa Rivers, and the water level of the artesian wells declines with time and at present is 6-7 m below the ground surface. In the middle reaches of the Shono-Kawa River the depths of the wells vary from 120 to 150 m and the pumping rate of a well of 10-12 inch hole size is about 3,500 - 5,000 cu m/day. (Gabriel-USGS)
W69-08895

THE EFFECT OF GEOLOGICAL STRUCTURE ON THE CHEMICAL COMPOSITION OF GROUNDWATER IN THE POPOVO POLJE AREA (FRENCH),
Energy Trust, Sarajevo (Yugoslavia).
Joca Mladenovic.
Hydrol of fractured rocks Vol 2, Proc Dubrovnik Symp (Oct 1965), Int Ass Sci Hydrol, Pub 74, p 645-653, 1967. 9 p, 3 fig, 1 map.

Descriptors: *Chemical properties, *Water properties, *Groundwater, *Geologic control, Structural geology, Water sources, Hydroelectric plants, Drainage, Groundwater movement, Surface-groundwater relationships, Rivers, Limestones, Dolomite, Sands, Hydrogeology, Sea water.
Identifiers: *Yugoslavia, Dalmatia, Coastal area.

The hydrochemical analysis of the waters of the Trebisnjica River, Dalmatia, was conducted for the purpose of evaluating the effects of water regime on springs located in the coastal area after the construction of a hydroelectric power station. The river basin, mainly consisting of limestones and dolmites, may be characterized as follows: (1) chemically, the groundwater consists of several types (bicarbonate of calcium, magnesium, sulfate, and chloride); (2) the chemical composition of groundwater is conditioned by the geological formations and by the effect of some marine conditions; (3) no underground channels exist between the river water and the high-altitude coastline between Slano and Neretva; and (4) the low-altitude coastline between Slano and Neretva is characterized by springs showing the existence of subterranean channels. (Gabriel-USGS)
W69-08896

WATER CHARACTERISTICS FROM SPRINGS IN THE LIMESTONE REGION OF CROATIA,
Institute of Sanitary Engineering, Zagreb (Yugoslavia).
Milivoj Petrik.
Hydrol of fractured rocks Vol 2, Proc Dubrovnik Symp (Oct 1965), Int Ass Sci Hydrol, Pub 74, p 624-634, 1967. 11 p, 4 fig, 41 ref.

Descriptors: *Springs, *Spring water, *Limestones, Geochemistry, Carbon dioxide, Calcium, Magnesium, Chloride, Sulfates, Water temperature, Alkaline water, Aquifers, Hardness (Water), Dolomite, Karst, Geology, Mesozoic era, Tertiary period, Rivers.
Identifiers: *Yugoslavia, Croatia, Spring water characteristics.

Water from 100 springs located throughout the limestone region of Croatia was analyzed and the analytical results and other data are presented. Determinations were made of free carbon dioxide, dissolved oxygen, carbonate and non-carbonate hardness, alkalinity, magnesium, calcium, and chloride contents. Temperature of the spring waters varied between 4.8 and 18.0 deg C. Altitude of the springs sampled ranges from sea level to about 1000 m above sea level. Results of the study were summarized for smaller sub-regions and some general sub-regional and regional characteristics were indicated. A comparison was made between the underground water of this region and water localized in the finely-grained aquifers of non-karstic parts of Croatia. Some of the characteristics of waters from four rivers are given. (Gabriel-USGS)
W69-08897

HYDROCHEMICAL CHARACTERISTICS OF GROUNDWATERS IN SARMATIAN AND MEDITERRANEAN-II LIMESTONES IN THE VICINITY OF BELGRADE,
Belgrade Univ. (Yugoslavia). School of Mining and Geology.
N. Milojevic, B. Filipovic, and N. Dimitrijevic.
Hydrol of fractured rocks Vol 2, Proc Dubrovnik Symp (Oct 1965), Int Ass Sci Hydrol, Pub 74, p 635-644, 1967. 10 p, 6 fig, 1 tab.

Descriptors: *Chemical properties, *Hydrologic properties, *Hydrogeology, *Groundwater, Limestones, Thermal properties, Tertiary period, Karst, Springs, Sinks, Fissures (Geology), Porosity, Water table, Hydrogen sulfide, Chlorides, Sodium, Potassium, Magnesium, Water types.
Identifiers: *Yugoslavia.

This paper discusses the effect of geological and other factors, such as the processes of leaching and infiltration, on the hydrochemical characteristics of groundwater. The origin of particular types of groundwater is also presented. The chemical composition of sodium hydrocarbonate type of waters depends on the original composition of waters subjected to desulfatization and on the chemical composition of rocks subjected to leaching. Factors that affect the composition of ground waters are: the original composition, rock porosity, rock composition, the presence of NaCl as a result of the 'struggle' between marine and continental environments, and the physiochemical laws operating in the processes of accumulation and movement of groundwaters. Diagrams and profiles illustrate the basic hydrochemical characteristics and a classification of the groundwater is given. (Gabriel-USGS)
W69-08898

SOLUBILITY RELATIONSHIP OF LIMESTONES AND DOLOMITES (FRENCH),
Institute for Geological and Geophysical Research, Belgrade (Yugoslavia).
Dragoljub Zogovic.
Hydrol of fractured rocks Vol 2, Proc Dubrovnik Symp (Oct 1965), Int Ass Sci Hydrol, Pub 74, p 615-623, 1967. 9 p, 3 fig, 5 tab, 9 ref.

Descriptors: *Solubility, *Limestones, *Dolomite, Natural flow, Karst, Aquifers, Carbonate rocks, Physicochemical properties, Crystalline rocks, Crystallization, Hydrogeology, Thermodynamic behaviour, Sulfates, Anhydrite, Calcite, Gypsum, Acidic waters.
Identifiers: *Solubility relationship, Hydrochemical properties.

The solubility of limestones and dolomites, as the main factor in forming karstic areas, is critically reviewed on the basis of earlier investigations by Lehman (1932, Leipzig and Wien), Leitmeier (1916, Stuttgart), Ogiljvi (1956, Moscow), Sokolov (1962, Moscow) and others. It is concluded that rock solubility depends mainly on the nature of crystal material where the energy of crystal lattice is of primary importance. The structure of calcareous rocks, the presence of various impurities and the character of a solvent strongly affect the solubility process. The degree of solubility of limestone and dolomite rocks depends on the hydrochemical and thermodynamic properties of aqueous solutions present in the karstic areas. (Gabriel-USGS)
W69-08899

TRACER DYNAMICS IN LAMINAR FLOW THROUGH POROUS MEDIA (ROMANIAN),
Academia R. P. R., Bucharest. Institutul de Fizica Atomica.
Emilian Gaspar.
Hidrotehnica, Gosp Apelor, Meteorol, Vol 13, No 6, p 298-303, June 1968. 6 p, 5 fig, 3 tab, 19 ref.

Descriptors: *Tracers, *Radioisotopes, *Laminar flow, *Porous media, Analytical techniques, Tracking techniques, Radioactive dating, Rock properties, Adsorption, Absorption, Permeability, Ion exchange.
Identifiers: *Tracer dynamics, Groundwater reservoir.

The paper discusses the use of tracer methods to solve hydrological problems. The dynamics of stable or radioactive tracers in groundwater is a very complicated process which cannot be entirely predicted. Laboratory experiments indicated that the concentration of radioactive tracers is a function of percolation time, length of soil column, average velocity, and longitudinal dispersion constants. The chemical, physical, and hydrological aspects of tracer and water movement through porous media should be known to evaluate the usefulness of tracer techniques in hydrology. The tracer can be retained by various geologic formations by adsorption, absorption, and ion exchange phenomena.

Tracer solubility in water, density, viscosity, and surface tension of tracer solution as well as the porosity and permeability of percolating media control to a large extent the movement of radioactive tracers in aquifer formations. Thermal and pressure variations within the water-bearing formations play an important role on hydrodynamic phenomena. There is a recognized need for basic research dealing with the use of radioisotopes in order to solve important hydrologic problems. (Carstea-USGS)
W69-08901

RECORDS OF WELLS AND SPRINGS, SAN ANTONIO AREA, TEXAS,
Geological Survey, Washington, D.C.
Paul Rettman.
Texas Water Develop Board-Edwards Underground Water Dist Rep, May 1969. 28 p, 6 fig, 1 tab, 7 ref.

Descriptors: *Water wells, *Springs, *Data collections, *Texas, Aquifers, Limestones, Water yield, Water levels, Water utilization.
Identifiers: Well data collections, *San Antonio (Tex), Edwards Limestone.

Records of wells and springs in the San Antonio area, Texas are tabulated. Most of the wells produce water from the Edwards and associated limestones. Each record consists of well number, owner's name, date completed, depth, diameter, depth to openings, length open to aquifer, finish, logs available, aquifers, land surface, altitude, depth to water, data of measurement, use of water, use of well, type of lift, power, and yield. Maps show well and spring locations. (Knapp-USGS)
W69-08903

HYDROLOGICAL YEAR-BOOK OF ISRAEL 1966-67.
Ministry of Agriculture, Jerusalem (Israel). Hydrological Service.
For primary bibliographic entry see Field 02E.
W69-08908

GROUND WATERS AND SURFACE WATERS OF THE BURIAT-MONGOLIAN A.S.S.R. AS A SOURCE OF AGRICULTURAL WATER SUPPLY (RUSSIAN),
G. V. Kopanev.
Izdatel'stvo Akad Nauk, SSSR, Moscow, 1960. 152 p, 24 fig, 11 tab, 80 ref.

Descriptors: *Agriculture, *Runoff, *Aquifers, Topography, Climates, River basins, Hydrologic data, Gaging stations, Hydrogeology, Mineral water, Water supply, Water utilization, Geology, Pollutants, Water chemistry, Water analysis, Water structure.
Identifiers: *USSR, Buriat, A.S.S.R. water resources.

Agricultural water supply in the Buriat-Mongolian A.S.S.R. was investigated on the basis of several earlier publications. The report describes general physical geography of the region and several chapters are devoted to the geohydrological conditions and agricultural potential. Surface water and groundwater relationships, runoff characteristics, and climate are discussed. The geology, groundwater types, regimes, and water quality are described. River systems, runoff distribution (both annually and periodically), and irrigation for pasture and other crops are discussed. (Gabriel-USGS)
W69-08912

RADIOACTIVE TRACERS IN HYDROLOGICAL RESEARCHES IN USSR,
Moscow State Univ. (USSR).
For primary bibliographic entry see Field 02E.
W69-08913

THE EFFECTS OF TEMPERATURE AND DENSITY GRADIENTS UPON THE MOVEMENT OF CONTAMINANTS IN SATURATED AQUIFERS,
Alabama Univ., University. Dept. of Engineering Mechanics.
Harold R. Henry.
Symp on Geochem, Precipitation, Evaporation, Soil-Moisture, Hydrom, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 78, p 54-65, 1968. 12 p, 4 fig, 26 ref.

Descriptors: *Saturated flow, *Diffusion, *Dispersion, *Convection, *Groundwater movement, Solutes, Wastes, Path of pollutants, Mathematical models, Currents (Water), Mass transfer, Aquifers.
Identifiers: Thermal gradients.

The effects of gradients in temperature and density on the movement of contaminants in groundwater were studied by imposing a horizontal lateral temperature gradient on a tube of square cross section containing water-saturated sand. A convection current increased in strength as the temperature gradient increased. The effective value of thermal diffusivity was about 50 times larger than the expected value because of dispersion caused by the movement of water through tortuously interconnected interstices of the sand. (Knapp-USGS)
W69-08921

HEAT CONDUCTIVITY OF WATER-BEARING SATURATED ROCKS AS A FUNCTION OF PRESSURE, TEMPERATURE, AND ROCK COMPOSITION (RUSSIAN),
Akademiya Nauk SSSR.
E. M. Bayramov, and A. B. Tsaturyants.
Izv Akad Nauk, Azerbaidzh. SSR, No 1, p 25-29, 1969. 5 p, 5 fig, 4 ref.

Descriptors: *Aquifers, *Groundwater, *Saturation, *Pressure, *Water temperature, *Rock properties, Geology, Exploitation, Air temperature, Porosity, Oil reservoirs, Moisture, Moisture content, Sampling, Clays, Sands, Bore holes.
Identifiers: USSR.

Heat conductivity of water-bearing and oil-bearing sedimentary rocks was experimentally investigated by using several combinations of clay and sand at various temperatures and pressures. Experimental arrangement and technique used was in accordance with a method developed by A. K. Abaszade, A. A. Gylmanov, and E. M. Bayramov (1965), with temperatures and pressures up to 80 deg C and 1,500 atm, respectively. Five graphs of heat conductivity versus pressure and rock composition, based on the experimental data, are given in the article. (Gabriel-USGS)
W69-08926

MONSOON OVER THE INDUS VALLEY DURING THE HARAPPAN PERIOD,
Council of Scientific and Industrial Research, New Delhi (India).
C. Ramaswamy.
Nature, Vol 217, No 5129, p 628-629, Feb 17, 1968. 2 p, 1 fig, 12 ref.

Descriptors: *Paleohydrology, *Paleoclimatology, *Monsoons, Groundwater, History, Quarternary period, Radioactive dating, Precipitation (Atomospheric).
Identifiers: *India, *Indus Valley, Harappan period.

Archaeological and hydrogeological studies show that the climate in the Indus Valley in the Harappan period (2500-1700 BC) was much wetter than the present climate. Detailed study of the 500, 300, and 200 harts suggests that quasi-stationary troughs occasionally extended into the area and induce monsoon activity. In the Harappan period such troughs must have extend more frequently into the Indus Valley than at present. Recent discovery of considerable groundwater reserves supports this idea. The C-14 age of the water is about 5,000 yr BP. (Knapp-USGS)
W69-08950

SINUOSITY IN LIMESTONE SOLUTION CONDUITS,
Pennsylvania State Univ., University Park. Dept. of Geology and Geophysics; Pennsylvania State Univ., University Park. Materials Research Lab.; and Pennsylvania State Univ., University Park. Dept. of Geochemistry and Mineralogy.
George H. Deike, and William B. White.
Amer J Sci, Vol 267, No 2, p 230-241, Feb 1969. 12 p, 5 fig, 2 tab, 23 ref.

Descriptors: *Channel morphology, *Karst, *Caves, *Missouri, *Kentucky. Closed conduit flow, Drainage, Limestones, Underground, Streamflow, Meanders.
Identifiers: Cave sinuosity, European caves.

Cave passages are regarded as segments of drainage conduits, and those with sinuous patterns are compared with the meander belts of surface streams. Caves were sampled from central Kentucky, Missouri, and various Appalachian and European reports. Caves that exhibited parallel uniform walls which did not branch in the measured reach were selected. Two types of nonlinearity were found: an angulate form generated by water flow down a hydraulic gradient diagonal to a rectangular joint set and a curvilinear form with sweeping S-bends apparently related to meanders in surface streams. The average bend spacing and channel width of the sinuous form are related by a power function. The constants are similar to those proposed for alluvial rivers. (Knapp-USGS)
W69-08952

GROUNDWATER--A NEGLECTED RESOURCE,
Geraghty and Miller, Port Washington, N.Y.
For primary bibliographic entry see Field 06D.
W69-09004

2G. Water in Soils

COMPUTER PROGRAM FOR CONVERTING NEUTRON PROBE READINGS TO SOIL WATER EQUIVALENTS,
Forest Service (USDA), New Orleans, La. Southern Forest Experiment Station.
For primary bibliographic entry see Field 07B.
W69-08639

IMPROVED STANDARDS FOR NEUTRON SOIL WATER METERS,
Forest Service (USDA), Oxford, Miss. Southern Forest Experiment Station.
For primary bibliographic entry see Field 07B.
W69-08640

SOIL-MOISTURE TRENDS AFTER THINNING AND CLEARCUTTING IN A SECOND-GROWTH PONDEROSA PINE STAND IN THE BLACK HILLS,
Forest Service (USDA), Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station.
Howard K. Orr.
USDA Forest Serv Res Note RM-99, 1968. 8 p, illus.

Descriptors: *Evapotranspiration, *Moisture deficit, *Percolation, *Retention, Moisture content, Moisture availability, Gravitational water, Forest management, Water conservation, South Dakota.
Identifiers: Black Hills.

Thinning from 190 square feet basal area and nearly 2,000 trees per acre to 80 square feet and 435 trees did not induce free water seepage in dry years when the unthinned stand did not yield seepage. Thinning reduced the soil moisture depletion potential, however, seepage depends on enough input moisture to overcome soil moisture deficits. Clearcutting and maintenance in bare condition did induce free water seepage even in dry years. (Author)
W69-08647

SOIL MOISTURE CONSTANTS AND PHYSICAL PROPERTIES OF SELECTED SOILS IN HAWAII,
Forest Service (USDA), Honolulu, Hawaii. Pacific Southwest Forest and Range Experiment Station.
Teruo Yamamoto.
US Forest Service Research Paper PSW-P2, 10 p, 1963. 4 fig, 4 tables, 20 ref.

Descriptors: *Soil moisture, *Soil physical properties, Hawaii, Land use, *Soil surfaces, Atterberg limits, Bulk density, Soil density, Specific gravity, Soil groups, Soil investigations.
Identifiers: Tropical soils.

The surface foot of 25 soils in 10 great soil groups were sampled. Surface vegetation, soil texture, Atterberg limits, bulk density, organic matter content, specific gravity, pH, and soil moisture constants are reported. (Merriam-Forest Serv)
W69-08648

WATER REPELLENT SOILS AND THEIR RELATION TO WILDFIRE TEMPERATURES,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
L. F. DeBano, and J. S. Krammes.
Bulletin of the I.A.S.H., XI Annee No 2, p 14-19, 1966.

Descriptors: *Waterproofing, *Soil temperature, *Burning, *Wettability, Infiltration, Soil erosion, Heat treatment, Soils, Watershed management, Overland flow, Heat transfer, Thermal conductivity.
Identifiers: Water repellent soils, Wildfires, *Non-wettable soils.

A naturally occurring water resistant soil was exposed to different burning times and temperatures after which the soil samples were tested for non-wettability. The less intense treatments produced an extremely non-wettable condition. Temperatures of 800 and 900 degrees applied for 20 minutes completely destroyed the non-wettable property. Heat treatments within the realm of soil temperatures existing during wildfires were capable of producing the extreme non-wettable condition. The increased surface runoff and erosion from burned southern California watersheds could be the result of this relationship. (DeBano)
W69-08657

FORMATION OF NON-WETTABLE SOILS...INVOLVES HEAT TRANSFER MECHANISM,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
Leonard F. DeBano.
US Forest Serv Res Note PSW-132, 1966. 8 p.

Descriptors: *Heat transfer, *Heat treatment, *Condensation, *Wettability, Waterproofing, Soil erosion, Burning, Soil temperature, Shrubs, Chaparral, Sands, Laboratory tests.
Identifiers: Hydrophobic substances, Vaporization and condensation.

After a wildfire, some brushland soils in southern Califirnia have been found to include a non-wettable layer. This formation may be the result of hydrophobic material volatilizing and later condensing. In burning experiments, hydrophobic substances from ceanothus litter and non-wettable soil were moved downward into an underlying wettable sand by temperature gradients. The wettable sand acquired a marked resistance to wetting after the burning treatment. (Author)
W69-08658

SOIL WETTABILITY AND WETTING AGENTS...OUR CURRENT KNOWLEDGE OF THE PROBLEM,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
Leonard F. DeBano, Joseph F. Osborn, Jay S. Krammes, and John Letey, Jr.
US Forest Serv Res Paper PSW-43, 1967. 13 p.

Descriptors: *Soils, *Wettability, *Surfactants, *Soil erosion, Burning, Waterproofing, Wetting, Grasses, Soil temperatures, Vegetation establishment, Heat transfer, Overland flow, Evaporation, Infiltration, Chaparral, Watershed management.
Identifiers: Hydrophobic substances, Wildfires, *Non-wettable soils.

Soils that resist wetting are a widespread phenomenon on chaparral areas of southern California watersheds. On burned watersheds, non-wettable soils markedly reduce moisture movement during both evaporation and infiltration. The reduced infiltration rate probably contributes significantly to the high debris production from the watersheds. Factors involved in the formation of non-wettable soils include vegetation and soil temperatures during fire. Wetting agents applied to burned areas apparently help retard debris movement and enhance vegetation establishment. (Authors)
W69-08659

SEED GERMINATION AND ESTABLISHMENT AS AFFECTED BY NON-WETTABLE SOILS AND WETTING AGENTS,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station; and California Univ., Riverside.
J. Osborn, J. Letey, L. F. DeBano, and Earl Terry.
Ecology, Vol 48, No 3, p 494-497, 1967.

Descriptors: *Germination, *Surfactants, *Vegetation establishment, *Wettability, Waterproofing, Grasses, Wetting, Seeds, Infiltration, Soil moisture, Slopes, Laboratory tests, Overland flow, Soils.
Identifiers: *Non-wettable soils, Seed germination, Annual ryegrass.

To study the effects of soil wettability and wetting agents on seed germination and establishment, three substrates (naturally occurring non-wettable soil, wettable soil, and a wettable quartz sand) were placed in small plastic containers and received applications of wetting agent in liquid, wetting agent on perlite, and no treatment as a control. The containers were seeded to wimmera ryegrass and were placed both on a 30 deg slope and on the level in a controlled temperature chamber (70 deg F). Seed placed on non-wettable soil which received no wetting agent treatment failed to germinate in those containers placed on the slope. Good germination occurred on soil which was treated with a wetting agent and on wettable sand. The same relationships occurred for the plants which were allowed to become established. Differences are primarily due to water relations; water ran off the sloping non-wettable soils. Wetting agent treatment on the wettable sand reduced both germination and establishment of the tested plants. (DeBano)
W69-08660

SOIL MOISTURE DEPLETION PATTERNS AROUND SCATTERED TREES,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
Robert R. Ziemer.
US Forest Serv Res Note PSW-166, 1968. 13 p, illus.

Descriptors: *Soil moisture, *Evapotranspiration, Soils, Watershed management, California, Water conservation, Neutron meters, Vegetation effects, Moisture deficits.
Identifiers: *Soil moisture depletion, Pinus lanbertiana.

Soil moisture was measured around an isolated mature sugar pine in the mixed conifer type of the central Sierra Nevada, California. Total moisture depletion from the 61-foot radius plot for the 1966 summer depletion season was 22.57 inches. (Author)
W69-08665

THE TESTING OF A METHOD FOR PREDICTING WATER INTAKE INTO SOILS BY THE USE OF FIELD CORES,
Purdue Univ., Lafayette, Ind. Water Resources Research Center.
Royce L. Lambert.
Doctor of Philosophy Thesis. Department of Agronomy, Purdue University. 100 p, 27 fig, 10 tab, 64 ref, 1 append. OWRR Proj No A-010-IND.

Descriptors: *Infiltration, Hydraulic, Conductivity, Infiltrometer, *Soil physical properties, Soil structure, Soil texture, Soil types, *Soil water, Vegetative effects, Approximation methods.
Identifiers: Green-Ampt Equation.

An approximate theory method for predicting infiltration based on the Green-Ampt equation was tested as to its applicability for use in the field. Field cores were taken into the laboratory and evaluated as to their water intake rates and then these values related to the parameters from the approximate theory equation. The infiltration rates as calculated by the approximate theory method were then related to those rates determined in the field by a sprinkling infiltrometer. The findings were that although the infiltration rates determined by the approximate theory method and those in the field were relatively similar, the values for the parameters involved in the equation were such they did not have any physical significance. This deviation was attributed to the wide variance in the physical structure of the soil in the field cores. (Wiersma-Purdue)
W69-08694

GEOLOGICAL CONDITIONS FOR THE FORMATION OF PEAT-BOGS OF THE CENTRAL PART OF WESTERN SIBERIA (RUSSIAN),
Moscow State Univ. (USSR). Dept. of Soil Science and Engineering Geology.
A. I. Sergeyev.
Vestnik Moskov Univ Nauch Zh, Ser 4, No 2, Geol, p 95-100, Mar-Apr 1969. 6 p, 2 fig, 2 tab, 5 ref.

Descriptors: *Geology, *Peat, *Bogs, Geomorphology, River basins, Flood plains, Clays, Sands, Lignite, Climates, Organic matter, Temperature, Chemical analysis, Sediments, Hydrologic properties, Forests, Salinity, Calcium, Carbonates, Lakes.
Identifiers: *USSR, Western Siberia, Peat bogs.

Geology and chemical composition of peat and peat waters of Western Siberia were investigated for the purpose of understanding the processes of their formation. The study of marsh-water indicates a gradual increase in pH and mineralization content from upper layers to the lower peat layers. Peat in the upper layers is formed under the prevailing acid conditions, whereas the lower peat layers are formed in the akaline or weakly-acidic media. Favorable climatic conditions, weak relief, and the presence of certain bedrocks can be considered as the main factors influencing the development of peat-bogs in Western Siberia. (Gabriel-USGS)
W69-08700

SULPHATE REDUCTION IN WATERLOGGED SOILS,
Rothamsted Experimental Station, Harpenden (England).
For primary bibliographic entry see Field 02K.
W69-08754

THE EFFECT OF THE CONCENTRATION AND MOVEMENT OF SOLUTIONS ON THE SWELLING, DISPERSION, AND MOVEMENT OF CLAY IN SALINE AND ALKALI SOILS,
Reading Univ. (England). Dept. of Soil Science.
D. L. Rowell, D. Payne, and N. Ahmad.
J Soil Sci, Vol 20, No 1, p 176-188, Mar 1969. 13 p, 6 fig, 14 ref.

Descriptors: *Expansive soils, *Ion exchange, *Water chemistry, *Alkaline soils, *Saline soils, Permeability, Hydraulic conductivity, Expansive clays, Impervious soils, Electrolytes, Montmorillonite, Adsorption, Laboratory tests, Soil mechanics, Dispersion, Diffusion.
Identifiers: Swelling clays, Swelling soils.

Changes in permeability of a soil containing montmorillonite, and the swelling of orientated aggregates of extracted clay have been found and compared with the concentrations at which aggregates dispersed in stationary solutions, and the concentrations at which soil suspensions dispersed when shaken. The results indicate that: (a) permeability begins to decrease at the same concentrations as the clay begins to swell, (b) the changes in permeability are directly controlled by the swelling of clay until clay dispersion and movement begins, (c) the concentration at which clay disperses depends on the mechanical stress applied, (d) when small mechanical stresses are applied, the proportion of the clay which swells and disperses depends directly on the exchangeable sodium percentage, and (e) large mechanical stresses may disperse most of the clay even at low exchangeable sodium percentages. (Knapp-USGS)
W69-08755

THE CONSTRUCTION OF CALIBRATION CURVES FOR DETERMINING WATER CONTENT FROM RADIATION COUNTS,
East Malling Research Station, Maidstone (England).
D. A. Holland.
J Soil Sci, Vol 20, No 1, p 132-140, Mar 1969. 9 p, 2 fig, 22 ref.

Descriptors: *Nuclear moisture meters, *Calibrations, *Statistical methods, Instrumentation, Measurement, Regression analysis, Soil moisture, Moisture content, Soil moisture meters, Radiation.
Identifiers: Nuclear soil moisture meters, Calibration curves.

The application of regression theory to the construction of calibration curves for the estimation of water content from an observed radiation count is possible only when the relationship between count and water content is linear, a homogeneous error applies to the dependent variate, count, whatever its value, and the independent variate, water content, is determined free of error. Determination of the errors of estimation is further complicated by the necessity to fit the regression of count, as the dependent variate, on water content and then to invert the equation in order to estimate moisture content from count. It is shown that these requirements can be fulfilled by an initial transformation of the data and by repeated subsampling for the determination of water content. A method is given for calculating errors of estimation. Experimentally, it was found that a transformation (logarithmic) was necessary when calibrating a beta-gage for leaf moisture measurement. When calibrating a neutron probe for soil-moisture measurement no transformation was required, but it was necessary to take repeated subsamples for water content determinations. (Knapp-USGS)
W69-08756

INFLUENCE OF TEXTURE ON THE MOISTURE CHARACTERISTICS OF SOIL: RELATIONSHIPS BETWEEN PARTICLE-SIZE COMPOSITION AND MOISTURE CONTENTS AT UPPER AND LOWER LIMITS OF AVAILABLE-WATER,
National Vegetable Research Station, Wellesbourne (England).
P. J. Salter, and J. B. Williams.
J Soil Sci, Vol 20, No 1, p 126-131, Mar 1969. 6 p, 2 tab, 8 ref.

Descriptors: *Moisture content, *Soil moisture, *Soil texture, Soil physical properties, Soil chemical properties, Regression analysis, Particle size, Porosity, Permeability, Organic matter, Soil classifications, Equations.
Identifiers: *Soil moisture-texture relationships.

A quantitative assessment was made of the effect of the proportion of sand, silt, clay, and organic matter in 26 soils on the moisture contents at the upper and lower limits of available-water of the soils. Regression equations were obtained which enabled the moisture contents to be estimated on a weight or volume basis from mechanical analysis data using either International or American size grades. The accuracy of estimating the upper limit of available-water from the various equations ranged from 9 to 22% for the lower limit, from 8 to 16% of the measured values. Mean values of the moisture contents at the upper and lower limits of available-water for each textural class were calculated from the average particle-size composition for each class and from the regressions obtained. (Knapp-USGS)
W69-08757

THE EFFECT OF HYSTERESIS OF PORE-WATER ON THE HYDRAULIC CONDUCTIVITY,
Agricultural Coll. of Athens (Greece). Dept. of Agricultural Chemistry.
A. Poulovassilis.
J Soil Sci, Vol 20, No 1, p 52-56, Mar 1969. 5 p, 2 fig, 16 ref.

Descriptors: *Soil water movement, *Hysteresis, *Hydraulic conductivity, Wetting, Water yield, Drying, Specific retention, Specific yield, Moisture content.
Identifiers: Hysteresis--hydraulic conductivity, Pore water.

It is pointed out with the help of the Independent Domain Theory that a fraction of pore-water is contained in pores not common to both the wetting and drying states and that this volume in a wetting state is contained in pores whose draining radii are greater than those of the pores in the drying state. It is suggested that hysteresis may affect the hydraulic conductivity through differences of the radii of the pores which tend to endow a wetting state with a conductivity greater than that of an equally wet but drying state; secondly, through differences of the coordinates of the above-mentioned pores, which may influence the paths of flow and consequently the hydraulic conductivity, and will have either a similar or opposite effect. It is concluded, therefore, that the conductivity in the wetting state can be greater, equal, or even less than that in the drying state, depending on the particular porous body. (Knapp-USGS)
W69-08760

INFILTRATION AS INFLUENCED BY TILLAGE-INDUCED RANDOM ROUGHNESS AND PORE SPACE,
Agricultural Research Service, Morris, Minn. Soil and Water Conservation Research Div.
R. E. Burwell, and W. E. Larson.
Soil Sci Soc Amer Proc, Vol 33, No 3, p 449-452, May-June 1969. 4 p, 3 fig, 3 tab, 9 ref.

Descriptors: *Infiltration, *Rainfall-runoff relationships, *Soil erosion, *Cultivation, Soil texture, Runoff, Soil physical properties, Permeability, Porosity, Soil conservation, Soil mechanics, Soil stabilization, Surface runoff, Erosion control.
Identifiers: Erosion index, Random roughness.

During simulated rainfall, increases in tillage-induced random roughness and pore space increased water infiltration before runoff started but did not significantly influence infiltration throughout a 5-cm runoff period. Random roughness provided a greater accounting of infiltration variation among tillage treatments to initial runoff than did total pore volume of the tilled layer. Freshly turnplowed alfalfa-bromegrass sod on Barnes loam and Nicollet sandy clay loam soil provided random roughness and pore space conditions that could accommodate without 'failure' the major portion of rainfall energy (as evidence by EI) expected in west central and southwestern Minnesota during the first 2 months following row crop planting. This is the critical runoff-erosion period in the Corn Belt. (Knapp-USGS)
W69-08935

RECESSION OF PERMAFROST IN A CULTIVATED SOIL OF INTERIOR ALASKA,
Alaska Agricultural Experiment Station, Palmer; and Soil Conservation Service, Palmer, Alaska.
Arvo Kallio, and Samuel Rieger.
Soil Sci Soc Amer Proc, Vol 33, No 3, p 430-432, May-June 1969. 3 p, 1 fig, 3 tab, 9 ref.

Descriptors: *Permafrost, *Thawing, *Cultivation, *Alaska, Soil physical properties, Soil temperature, Soil water, Soil structure, Freezing, Cold regions, Frozen ground.
Identifiers: Tanana soil series, Pergelic soils.

Soil temperatures above and within the perennially frozen zones of Tanana silt loam, a member of the subgroup of Pergelic Cryaquepts, were measured twice-weekly over a period of 3 years in undisturbed, cleared, perennial grass, and potato plots. The permafrost table receded rapidly from a depth of about 1 m to almost 5 m after clearing. Refreezing in autumn and winter takes place simultaneously downward from the surface and upward from the new permafrost table. In the potato plot, an unfrozen zone remained throughout the winter. Mean annual temperatures above the new permafrost table are warmer than 0 deg C. Some revision in the definition of Pergelic subgroups in the Comprehensive Classification System seems necessary to avoid a change in classification of the soil as a result of clearing and cropping. (Knapp-USGS)
W69-08936

INFLUENCE OF THE COPPER, ZINC, IRON, AND ALUMINUM SALTS OF SOME MICROBIAL AND PLANT POLYSACCHARIDES ON AGGREGATION AND HYDRAULIC CONDUCTIVITY OF RAMONA SANDY LOAM,
California Univ., Riverside. Dept. of Soils and Plant Nutrition.
J. P. Martin, and S. J. Richards.
Soil Sci Soc Amer Proc, Vol 33, No 3, p 421-423, May-June 1969. 3 p, 3 tab, 17 ref.

Descriptors: *Hydraulic conductivity, *Water chemistry, *Ions, *Organic compounds, *Soil structure, Wettability, Ion exchange, Soil physical properties, Soil chemical properties, Soil aggregates.
Identifiers: Polysaccharides.

The influence on soil aggregation and hydraulic conductivity of some microbial and plant polysaccharides and their Fe, Al, Cu, and Zn salts was determined. Specific effects were dependent upon the polysaccharide and the metal ion. In general, Fe and Al sharply reduced the effectiveness while Cu and Zn slightly reduced, exerted little effect or increased their binding action. Chromobacterium violaceum polysaccharide and Karaya gum improved both aggregation and hydraulic conductivity. The polysaccharides from Azotobacter indicus and Arthrobacter viscosus increased aggregation but did not alter hydraulic conductivity. Azotobacter chroococcum polysaccharide in concentrations up to 0.1% improved hydraulic conductivity but did not affect aggregation while ammonium-alginate exerted no effect on either soil property. (Knapp-USGS)
W69-08937

CONTRIBUTION OF SOME SOIL FUNGI TO NATURAL AND HEAT-INDUCED WATER REPELLENCY IN SAND,
California Univ., Riverside. Dept. of Soils and Plant Nutrition.
S. M. Savage, J. P. Martin, and J. Letey.
Soil Sci Soc Amer Proc, Vol 33, No 3, p 405-409, May-June 1969. 5 p, 3 fig, 3 tab, 15 ref.

Descriptors: *Infiltration, *Permeability, *Wettability, *Soils, *Fungi, Temperature, Soil water movement, Sands, Wetting, Soil chemical properties, Soil physical properties.
Identifiers: *Water repellent soils.

Eight species of fungi isolated from a water repellent soil were incubated for varying periods of time in silica sand. In their latter stages of growth, two of the fungi, Aspergillus sydowi and Penicillium nigricans, cause limited water repellency in the sand. All the fungal sand cultures exhibited water repellency when heated briefly at temperatures between 200 C and 400 C. The times required to produce and destroy water repellency in the sand cultures at the various temperatures were similar to those required by the natural soil from which the fungi were isolated. The fungal sand cultures and natural water repellent soils were extracted with either water, methanol, acetone, or ethyl ether. The methanol and water extractions destroyed the natural water repellency of the A. sydowi and P. nigricans cultures. Methanol and water extractions also destroyed the water repellency of the heated sand cultures if the extractions were made before the heat treatments; however, if the extractions were made after the sand cultures had been heated, the water repellency of the samples was not affected. Wettable silica sand treated with the methanol extracts of the sand cultures exhibited water repellency when heated. Both the heat-induced and natural water repellency of the soil was not affected by any of the solvent extractions, but wettable sand treated with each of the extracts was made water repellent by heat. A variety of known organic substances was applied to wettable silica sand and the water repellency of the treated sand determined before and after heating. Amines were the only class of substances tested that caused water repellency in sand before heating. A variety of substances, however, caused head-induced water repellency in the sand. The heating conditions required to cause repellency were similar to those required by fungal sand cultures and natural water repellent soil. The primary conclusion of the study was that heat-induced water repellency may be a universal property of soils rather than property specific to a limited number of soils. (Knapp-USGS)
W69-08938

SOIL WATER EVAPORATION: SURFACE RESIDUE RATE AND PLACEMENT EFFECTS,
Agricultural Research Service, Mandan, N. Dak. Northern Plains Branch.
For primary bibliographic entry see Field 02D.
W69-08953

THE MOVEMENT AND STORAGE OF WATER IN NORTH CAROLINA SOILS AND THE ROLE OF THE SOIL IN DETERMINING WATER QUALITY,
North Carolina Univ., Chapel Hill. Water Resources Research Inst.
J. Fulton Lutz.
Water Resources Research Institute Report No. 24, June 1969. 43 p. OWRR Project A-008-NC.

Descriptors: *Soil water movement, *Storage capacity, *Soil physical properties, *Water quality, *Pollution (Soil), *Cation exchange, *Anion exchange, Porosity (Soil), Soil density, Soil water, Percolation, Permeability, Leaching, Herbicides, Pesticides, Clay minerals.
Identifiers: Available water, Bulk density, Weathering, Clay decomposition, Mineral losses.

Three related but separate phases of work are reported. (1) Study of the physical properties of the soils of North Carolina. Sixty-nine soil series representing approximately two-thirds of the total land area of the State were sampled, and the following determinations made: Depth of the A and B horizons, bulk density, total porosity, hydraulic conductivity, and the available, the unavailable, and the total water-holding capacities of the A and B horizons. The data should be valuable in planning water control (irrigation and drainage) in erosion control, in various phases of engineering, and in urban development (septic tanks and drainage). (2) Herbicide losses. Suspensions of kaolinite and montmorillonite were treated with two different rates of six herbicides and the amount of herbicide removed in increasing pressure increments determined, using the pressure membrane apparatus. Herbicides used were 2,4-D, simazine, atrazine, diuron, fluometuron, and CIPC. All herbicides, at both rates, were more readily lost from kaolinite than from montmorillonite. Simazine concentrations were greater in the higher pressure increments, but concentration of all others decreased as the pressure increased. (3) Cation and anion losses from clay minerals. Sodium and calcium montmorillonite were suspended in water and in the respective salts. Calcium kaolinite was suspended in water and in calcium chloride. Extracts were obtained at successively increasing pressures and the extracts analyzed for chloride, aluminum, and silicon. Essentially no aluminum was removed at any pressures, but silicon concentration ranged from 10 to 183 ppm. (Author)
W69-09028

2H. Lakes

RESOURCE SUBDIVISION AMONGST COHABITING FISH SPECIES IN A BAY, LAKE OPINICON, ONTARIO,
Queen's Univ., Kingston (Ontario).
Allen Keast.
Mich Univ, Great Lakes Res Div, Pub No 13, p 106-132, 1965. 5 fig, 15 tab, 21 ref.

Descriptors: *Fish, *Fish food organisms, *Food habits, Biomass, Bullheads, Pikes, Rock bass, Shiners, Silversides, Yellow perch.
Identifiers: Black crappie, Bluegill, Smallmouth bass.

The food habits of nine species of fish inhabiting a small bay of 800-hectare Lake Opinicon were determined. Fish were collected at three times during the day from May through September. Collections of plankton and bottom organisms were made in the same area. The diets of the fish species were analyzed by month, fish being grouped into size classes designed to elucidate differences in diet. Abundance of food organisms and number occurring in stomachs (all species of fish combined) were highly positively correlated for Cladocera, Amphipoda, Chironomidae (larvae and pupae) and Mollusca and highly negatively correlated for Copepoda. Cladocera and Chironomidae comprised the major food sources (by number) with Cladocera being utilized by all species of fish. Graphical and tabular data include stomach analyses by per cent volume, detailed diets of all fish species, and relative abundance and biomass estimates of all fish species. (Voightlander-Wis)
W69-08669

THE BOTTOM SEDIMENTS OF LAKE MONONA, A FRESH-WATER LAKE OF SOUTHERN WISCONSIN,
Wisconsin Univ., Madison.
W. H. Twenhofel.
J Sedimentary Petrology, Vol 7, No 2, p 67-77, Aug 1937. 3 fig, 1 tab, 4 ref.

Descriptors: *Bottom sediments, *Fresh water, *Lakes, Sludge, Mud, Marl, Calcium carbonate, Magnesium oxide, Iron, Aluminum, Lithification, Shale, Limestone, Wisconsin.
Identifiers: Organosilicon, Argillaceous limestone, Insoluble matter, Advent of white man, Lake Monona (Wis).

The bottom sediments of fresh water Lake Monona, Wisconsin, consist of a surface layer of black sludge high in organic matter and organosilicon, and a lower layer of firm, light-colored mud or marl. The sludge is composed of 30 to 45% calcium carbonate and 35 to 50% of insoluble residue. The marl contains from 50 to 70% calcium carbonate, 1 to 2% magnesium oxide, 15 to 25% of insoluble residue, and small amounts of iron and aluminum oxides. Lithification of the two layers would produce calcareous shale and siliceous-argillaceous limestone, respectively. The high content of insoluble matter in the sludge is correlated with occupation of the region by white man. (Wilde-Wis)
W69-08671

EUTROPHICATION OF INLAND WATERS.
Water Pollution Research Lab., Stevenage (England).
For primary bibliographic entry see Field 05C.
W69-08672

THE PHYSICAL AND CHEMICAL CHARACTERISTICS OF THE SEDIMENTS OF LAKE MENDOTA, A FRESH WATER LAKE OF WISCONSIN,
Wisconsin Univ., Madison.
W. H. Twenhofel.
J Sedimentary Petrology, Vol 3, No 2, p 68-76, Aug 1933. 3 fig, 3 tab, 2 ref.

Descriptors: *Bottom sediments, *Fresh water, *Lakes, *Chemical analysis, Calcareous soils, Silica, Iron, Aluminum, Organic matter, Diatoms, Microorganisms, Mud, Wisconsin.
Identifiers: Holorganic oozes, Substratum, Lamination, Bedding, Fossil, Organisms, Lake Mendota, Wisconsin.

Sediments covering the bottom of fresh water Lake Mendota, Wisconsin, consist of two distinct layers: the surface layer of nearly holorganic black oozes harboring small, thread-like worms; the substratum of light gray calcareous sediments changing with depth to white marl. The latter fine-grained, mineral sediments are believed to extend to a depth of 35 feet beneath the present bottom. Their average composition includes 60 to 80% carbonate, largely that of calcium, 20% silica, and small amount of iron and aluminum oxides. The empoverishment of the substratum in organic matter is attributed to the activity of microorganisms. Careful search revealed no lamination or bedding of muds. Except for diatoms, marl is almost devoid of fossil organisms. The findings are applicable only to sediments formed in lakes of the same character and located in similar surroundings. (Wilde-Wis)
W69-08675

GEOLOGICAL CONDITIONS FOR THE FORMATION OF PEAT-BOGS OF THE CENTRAL PART OF WESTERN SIBERIA (RUSSIAN),
Moscow State Univ. (USSR). Dept. of Soil Science and Engineering Geology.
For primary bibliographic entry see Field 02G.
W69-08700

FLORIDA LAKES-PART 3, GAZETTEER.
Florida State Board of Conservation, Tallahassee. Div. of Water Resources.

Florida Board of Conserv, Div of Water Resources Rep, 1969. 145 p, 6 map, 2 ref, append.

Descriptors: *Lakes, *Florida, *Data collections, Surveys, Size, Surfaces, Altitude, Watersheds (Basins).
Identifiers: Florida Lakes Gazetteer.

Florida lakes of 10 acres or more are listed alphabetically and by drainage basins. Altitudes, surface areas, and drainage areas are tabulated. A state index map and 5 aerial maps show the principle drainage and the lakes. (Knapp-USGS)
W69-08753

A COASTAL POND STUDIED BY OCEANOGRAPHIC METHODS,
Woods Hole Oceanographic Institution, Mass.
K. O. Emery.

New York, American Elsevier Publ Co Inc, 1969. 80 p, 9 tab, 41 fig, 75 ref.

Descriptors: *Lakes, *Sediments, *Surface-groundwater relationships, *Life cycles, *Massachusetts, Hydrologic budget, Human population, Aquatid life, Water quality, Organic matter, Water temperature, Stable isotopes, Gases, Saline water, Oceans, Climates, Model studies.
Identifiers: *Oceanographic methods, Woods Hole (Mass), Cape Cod.

This monograph describes an inexpensive backyard model study using Oyster Pond, a coastal body of water on Cape Cod as the ocean. The study cuts through much of the whole field of oceanography; it is suggested that the widespread occurrence of such ponds in the United States and other countries useful environments for oceanographic education since many problems are common to both ocean and the ponds. The history of Oyster Pond is traced to 14,000 years ago; the climate, topography, geology, sediments, and water characteristics are well described. Since precipitation plus groundwater inflow from shoreline seeps and springs greatly exceed evaporation the pond normally overflows about 3,100 cu m per day to the ocean 98% of the time. Inflow of groundwater corresponds to 4 cu m per day per linear m of marine shoreline, a high rate of infiltration due to sandy, very permeable glacial till. Based upon sediment deposition the past 200 yr, Oyster Pond can remain a water body for 4,000 yr more if the sea level remains as now and man's activities do not materially alter the pond. (Lang-USGS)
W69-08922

WIND-DRIVEN CIRCULATION IN A TWO LAYER LAKE,
Wisconsin Univ., Madison.
J. A. Hoopes.
Paper presented at Seventh National Fall Meeting of American Geophysical Union, San Francisco, California, December 2-4, 1968. OWRR Project B-009-Wis.

Descriptors: *Interfaces, Limnology, Viscosity, Density, Stratifications, Free surfaces, Wind pressure.
Identifiers: *Steady state circulation model, Near shore boundary currents, Wind shear, Internal friction, Vertical motion.

A theoretical model of the steady-state circulation in a two-layer lake has been investigated. This model, which incorporates the effects of wind shear, internal friction, and vertical motion, is a solution to the linearized equations of motion (i.e., assuming small Rossby number). The eddy viscosity and density are assumed constant in each layer, and the shear, velocity, and pressure are assumed to be continuous across the interface between the layers. Applying the model to a circular lake of constant depth, analytical expressions have been obtained for the three-dimensional velocity distribution and for the shape of the free surface and the interface due to: (1) a steady, uniform wind stress; and (2) a steady, constant curl wind stress. The shape of the interface, as predicted by this model, is in agreement with some experimental observations made in a one-foot diameter, circular cylinder. These results tend to support Csanady's prediction of concentrated, near-shore boundary currents or 'coastal jets' in large lakes (see G. T. Csanady, 'Large-Scale Motion in the Great Lakes', J. Geophys. Res., 72, 4151-4162, 1967); however, Csanady's frictionless model of the circulation predicts more concentrated interfacial depth changes near shore than were observed in the model. (Author)
W69-09012

AN IMPROVED METHOD FOR EXTRACTION OF ORGANOCHLORINE AND ORGANOPHOSPHATE INSECTICIDES FROM LAKE WATERS,
Wisconsin Univ., Madison.
J. G. Konrad, H. B. Pionke, and G. Chesters.
Analyst, Vol 94, May 1969, p 490-492. OWRR Proj B-016-Wis.

Descriptors: *Separation techniques, *Organophosphorus pesticides, *Aldrin, *Dieldrin, *Endrin, Diazinon, Chromatography.
Identifiers: *Gamma-BHC, *Heptachlor epoxide, *Parathion-methyl, Parathion, Malathion.

The sensitivity of a benzene extraction method described previously for the extraction of organochlorine and organophosphate insecticides from lake waters has been increased from 20 to 200 times with little loss in accuracy or reproducibility. Average recoveries of gamma-BHC, aldrin, heptachlor epoxide, dieldrin, endrin, pp'-TDE, PP'-DDT, pp'-methoxychlor, phorate, parathion-methyl, diazinon, parathion and malathion ranged from 93.5 to 99.5 percent at concentrations of 0.062 to 1.165 micrograms per litre, the concentrations being chosen within this range to allow simultaneous gas-liquid chromatographic detection of a mixture of insecticides in a single extraction. Average recovery of heptachlor was 89.4 percent, presumably due to loss of heptachlor from the system by either degradation or volatilization. (Chesters-Wis)
W69-09016

FRACTIONATION OF INORGANIC PHOSPHORUS IN LAKE SEDIMENTS: I. RELEASE AND RESORPTION OF PHOSPHORUS DURING FRACTIONATION,
Wisconsin Univ., Madison.
For primary bibliographic entry see Field 05C.
W69-09019

FRACTIONATION OF INORGANIC PHOSPHORUS IN LAKE SEDIMENTS: II. FORMS AND AMOUNTS OF INORGANIC PHOSPHORUS,
Wisconsin Univ., Madison.
For primary bibliographic entry see Field 05C.
W69-09020

MEASUREMENT OF BIOLOGICAL N2 FIXATION,
Wisconsin Univ., Madison.
R. H. Burris.
Paper presented at Meeting of IBP on Microbial Production, Leningrad, May 27-31, 1969, 9 pages, 3 fig, 12 ref. OWRR Project B-020-Wis.

Descriptors: *Nitrogen fixation, *Lakes, Acetylene reduction, *Soils.
Identifiers: *Lakes, *Nitrogen fixing agents.

The N2 fixing enzyme system reduces not only N2 but also acetylene, azide, N20, cyanide, methyl isocyanide and certain analogues of these compounds. The reduction of acetylene serves as a sensitive index for the activity of the N2-fixing enzyme complex, because the ethylene produced from acetylene can be measured readily by gas chromatography. The method can be applied readily in the field with simple equipment. It has been used for studying N2 fixation in soils, by leguminous and non-leguminous root nodules, by blue-green algae from lakes and by purified enzyme preparations in the laboratory. The manuscript describes methods for sampling, exposure of samples to acetylene and analysis for ethylene production. The investigator should be sure to compare acetylene reduction with N2 reduction to establish a proper conversion factor to permit calculation of N2 fixation. (Author)
W69-09021

MODEL STUDIES AND NUMERICAL SOLUTIONS OF THE CIRCULATION IN LAKE SUPERIOR,
Wisconsin Univ., Madison.
J. A. Hoopes, S. L. Lien, and J. W. Mitchell.
Paper presented at 12th Conference on Great Lakes Research, Ann Arbor, Michigan, May 5-7, 1969. OWRR Project B-009-Wis.

Descriptors: *Lake Superior, *Numerical analysis.
Identifiers: *Wind-driven circulation, *Surface currents, Two-layer lake, Variable geometry.

The steady, wind-driven circulation in Lake Superior has been investigated using a rotating, vertically distorted laboratory model and numerical solutions of the equations of fluid motion. The laboratory model, which was designed on the basis of equality of Froude and Rossby numbers between the model and Lake Superior, was constructed with horizontal and vertical length scale ratios of 1:300,000 and 1:1,000 respectively and is rotated at 4.86 rpm. Surface currents, generated by blowing air over the model, are determined by measuring the displacements and directions of small floating particles photographically. In experiments with the model, surface currents and streamline patterns have been measured for both a homogeneous and a two-layer lake, subject to uniform and constant curl, wind stress distributions, though the patterns are more pronounced with the constant curl stress. For the homogeneous lake, the predominant feature of the circulation is a strong (up to 2 knots), narrow (1-10 miles wide), counterclockwise current around the lake perimeter. For the two-layer lake, delta phi/phi=0.0005, these same current patterns are observed. In addition, the upper layer forms a narrow band 1-10 miles wide around the lake perimeters. Numerical computations of the free surface and interface displacements and the vertically integrated volume transports have been made using a finite difference form of the steady-state, frictionless equations of motion. These solutions take into account the variable geometry of Lake Superior (i.e., both horizontal and depth variations) and have been carried out for a homogeneous and a two-layer lake. The results of these numerical computations are in agreement with the experimental observations in the laboratory model and with field observations, principally along the southern shore of the lake. (Hoopes-Wis)
W69-09022

COASTAL CURRENTS IN STRATIFIED SEAS,
Wisconsin Univ., Madison.
G. T. Csanady.
Paper presented at Midwest Geophysics Colloquium, Ann Arbor, Michigan, May 9-10, 1969. OWRR Project B-009-Wis.

Descriptors: Stratification, Limnology, Great lakes, Lake Huron, Currents (Water), Coastal structure.
Identifiers: Kelvin waves, Wave velocity, Coastal jets.

The linearized equations of motion for a stratified liquid are shown to possess steady-state solutions similar in spatial structure to Kelvin waves, in which the velocity amplitude decays exponentially with distance from a straight shore. A combination of various different free modes of this kind can result in 'coastal jets' of fairly complex structure. Application of the results to idealized models of the Great Lakes suggests that stratification may indeed be at least a contributory cause of the complexities of 'coastal jets' observed, for example, in Lake Huron. (Author)
W69-09026

2I. Water in Plants

ALKALI SACATON SEEDLING SURVIVAL AND EARLY GROWTH UNDER TEMPERATURE AND MOISTURE STRESS,
Forest Service (USDA), Albuquerque, N. Mex. Rocky Mountain Forest and Range Experiment Station.
Earl F. Aldon.
Rocky Mountain Forest and Range Experiment Station, USDA Forest Service Res Note RM-136, 1969. 4 p, illus.

Descriptors: *Grasses, *Erosion, *Ranges, Erosion control, Soil stabilization, New Mexico.

The optimum growing conditions for alkali sacaton seedlings are 85 deg F and soil moisture at field

capacity. Five other temperatures and one other soil moisture level were tested for their effect on shoot and root growth, shoot and root weight and seedling survival. In another study alkali sacaton seedlings were subjected to 19 different watering schedules representative of summer thundershower conditions. Survival was better after 5, 10, 15, and 20 days in those pots that were rewatered once. Alkali sacaton plants seem to need rewatering after 5 or 10 days. If they received additional moisture during this time, survival was much better (91 percent to 99 percent) than if these young plants were forced to go longer before another wetting (Survival dropped below 76 percent). (Author)
W69-08643

METHODS OF MEASURING AND ANALYZING RAINFALL INTERCEPTION BY GRASS,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
Robert P. Crouse, Edward S. Corbett, and Donald W. Seegrist.
Bulletin of the I.A.S.H., XI Annee No 2, p 110-120, 1966.

Descriptors: *Rainfall, *Interception, *Measurement, *Grasses, Instrumentation, Water loss, Precipitation (Atmospheric), Canopy, Storms, Storm structure, Plant growth, Waterproofing.
Identifiers: Interception storage capacity, Ground cover, Plant height, Shower frequency.

In studies at San Dimas Experimental Forest, near Glendora, California, the water storage capacity of grasses was proportional to the product of average height and percent of ground cover. The total interception loss for a storm was a function of the storage capacity and the number of showers per storm. (Authors)
W69-08656

RAINFALL INTERCEPTION BY ANNUAL GRASS AND CHAPARRAL...LOSSES COMPARED,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
Edward S. Corbett, and Robert P. Crouse.
US Forest Serv Res Paper PSW-48, 1968. 12 p.

Descriptors: *Chaparral, *Grasses, *Interception, *Rainfall, Precipitation (Atmospheric), Measurement, Instrumentation, Water loss, Canopy, Mulching, Storms, Storm structure.
Identifiers: Litter.

Loss of precipitation due to interception by annual grass and grass litter was measured during three rainy seasons on the San Dimas Experimental Forest, in southern California. Interception loss from annual grass averaged 7.9 percent; that from mature chaparral cover, 12.8 percent. If chaparral stands were converted to grass, an estimated 1.3 inches of gross interception could be saved each year. (Authors)
W69-08662

INTERNAL WATER STATUS OF PLANTS,
Nebraska Univ., Lincoln. Water Resources Research Inst.
Jerry D. Eastin, Charles Y. Sullivan, and E. J. Kinbacher.
Project Completion Rept, July 1969. OWRR Project A-005-NEB.

Descriptors: *Water stress, *Photosynthesis, Respiration, Carboxylating enzyme.

Sorghum (Sorghum bicolor (L.) Moench) is a crop known for its ability to persist under heat and moisture stress and often to make productive economic recovery once stresses are alleviated. The mechanisms permitting sorghum and other plants to exist under water stress are not well understood and thus cannot be fully exploited. To gain perspective in this area whole plant photosynthesis and respiration were estimated by monitoring CO_2 exchange as water stress was increased. Also activity of the primary carboxylating enzyme was assayed as water stress increased. Carbon dioxide uptake in light remained comparatively high until leaf water potential approached 20 atmospheres at which time CO_2 exchange was near the compensation point. Simultaneously leaf resistance increased from about 0.3 to 0.5 min/cm. A sharp increase in leaf resistance (about 2 min/cm) was noted near 25 atmospheres. Evolution of CO_2 in darkness increased 2-3 fold over a normal turgid condition at about 20 atmospheres water potential. As stress increased (> 25 atmospheres) dark CO_2 evolution was reduced to a rate comparable to the turgid condition. Dark CO_2 uptake was noted but its significance is difficult to assess. Phosphoenolpyruvic carboxylase activity remained quite high as water stress increased. In view of this the rapidly increasing leaf resistances with increasing water stress suggest the limitation observed on photosynthesis is associated with stomatal closure rather than failure of the carboxylation enzyme. (Authors)
W69-08887

BLASTOCLADIA AND AQUALINDERELLA: FERMENTATIVE WATER MOLDS WITH HIGH CARBON DIOXIDE OPTIMA,
California Univ., Berkeley. Dept. of Botany.
A. A. Held, R. Emerson, M. S. Fuller, and F. H. Gleason.
Science, Vol 165, No 3894, p 706-709, Aug 15, 1969. 4 p, 2 fig, 2 tab, 18 ref.

Descriptors: *Plant physiology, *Plant growth, *Carbon dioxide, *Fermentation, Aquatic fungi, Anaerobic conditions, Aerobic conditions, Ecological distribution, Oxygen requirements, Temperature.
Identifiers: *Water molds, Blastocladia, Aqualinderella.

The suggested existence of a polyphyletic group of fermentative water molds adopted to anaerobic environments rich in carbon dioxide has been confirmed by studies described in this paper. The uniflagellate aquatic phycomycete Blastocladia ramosa apparently is a facultative anaerobe. Blastocladia pringsheimii requires oxygen traces. Growth of both species is little or no greater at normal atmospheric oxygen pressure than under 0.2% oxygen pressure, but the addition of 5 to 20% carbon dioxide enhances growth. The cells of both species lack typical cristate mitochondria and contain only traces of cytochrome. Blastocladia resembles the biflagellate Aqualinderella fermentans in adaptation to an environment poor in oxygen and rich in carbon dioxide. (Lang-USGS)
W69-08923

ON THE POSSIBILITY OF QUANTITATIVELY EXTENDING PRECIPITATION RECORDS BY MEANS OF DENDROCLIMATOLOGICAL ANALYSIS,
National Center for Atmospheric Research, Boulder, Colo.; and Arizona Univ., Tucson. Lab. of Tree-Ring Research.
For primary bibliographic entry see Field 02B.
W69-08929

2J. Erosion and Sedimentation

EMERGENCY MEASURES TO CONTROL EROSION AFTER A FIRE ON THE SAN DIMAS EXPERIMENTAL FOREST,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
For primary bibliographic entry see Field 04A.
W69-08652

SOIL SLIPPAGE INCREASED BY BRUSH CONVERSION,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
For primary bibliographic entry see Field 04A.
W69-08655

SEASONAL DEBRIS MOVEMENT FROM STEEP MOUNTAIN SLIDE SLOPES IN SOUTHERN CALIFORNIA,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
For primary bibliographic entry see Field 04A.
W69-08664

THE BOTTOM SEDIMENTS OF LAKE MONONA, A FRESH-WATER LAKE OF SOUTHERN WISCONSIN,
Wisconsin Univ., Madison.
For primary bibliographic entry see Field 02H.
W69-08671

THE PHYSICAL AND CHEMICAL CHARACTERISTICS OF THE SEDIMENTS OF LAKE MENDOTA, A FRESH WATER LAKE OF WISCONSIN,
Wisconsin Univ., Madison.
For primary bibliographic entry see Field 02H.
W69-08675

A NEW 'SPHINCTER' CORER WITH A RECOILLESS PISTON,
SACLANT ASW Research Centre, La Spezia (Italy).
For primary bibliographic entry see Field 07B.
W69-08696

MIDDLE ATLANTIC CONTINENTAL SLOPE OF UNITED STATES: DEPOSITION AND EROSION,
Columbia Univ., Dobbs Ferry, N.Y. Hudson Labs.
Peter A. Rona.
Amer Ass Petrol Geol Bull, Vol 53, No 7, p 1453-1465, July 1969. 13 p, 11 fig, 33 ref.

Descriptors: *Sedimentation, *Erosion, *Continental shelf, *Continental slope, *United States, Marine geology, Sediments, Deposition (Sediments), Stratification, Sediment transport, Sedimentary structures, Groundwater movement, Springs, Aquifers.
Identifiers: Continental slope sediments, *Middle Atlantic shelf.

Continuous seismic reflection profiles across outer continental terrace (outer continental shelf and slope) show that directly off Cape Hatteras reflection interfaces (sedimentary strata) with low seaward inclination of about 1 deg underlie the continental shelf and terminate at the continental slope, which inclines about 9 deg. On traverses about 200 km north of Cape Hatteras, reflection interfaces (sedimentary strata) do not terminate but incline about 3 deg nearly parallel with the continental slope. On the continental slope about 100 km north of Cape Hatteras both relationships are present. The association of erosional and depositional features is consistent with a model of continental terrace development in which strata accumulate on the continental shelf by upbuilding and on the continental slope by outbuilding while basement subsides during seaward tilting. At the continental slope, strata are terminated primarily by erosional processes. Periodically, rotational slumping at the continental slope occurs, causing strata from the slope and outer shelf to shift to the continental rise and exposing shelf strata at the edge of the continental terrace. (Knapp-USGS)
W69-08699

FACTORS AFFECTING SETTLING OF SILT FROM SUSPENSION ALONG THE EDGE OF THE EASTERN WADDEN SEA (THE NETHERLANDS),
Ijsselmeerpolders Development Authority, Kampen (Netherlands). Dept. of Research.
C. Berger.
Eng Geol, Vol 2, No 5, p 341-349, Aug 1968. 9 p, 4 fig, 2 tab, 6 ref.

Descriptors: *Sedimentation, *Estuaries, *Ponds, Drainage, Tides, Currents (Water), Waves

(Water), Turbulence, Silts, Clays, Deposition (Sediments), Aggradation, Erosion, Sediment yield, Sediment control.
Identifiers: *Netherlands, *Wadden Sea, Polders, Ijsselmeer.

Rows of settling ponds were constructed parellel and perpendicular to the edge of Wadden Sea, in the Netherlands. An 11-year sampling program showed that silt deposition decreases toward the coast, clay content in the pond-drainage ditches increases toward the coast, and clay content in the polder fields increases toward the coast. (Knapp-USGS)
W69-08705

BED THICKNESS AND GRAIN SIZE: CROSS-BEDDING,
Illinois Univ., Urbana; and Indiana Univ., Bloomington.
Adrian E. Scheidegger, and Paul Edwin Potter.
Sedimentology, Vol 8, No 1, p 39-44, Feb 1967. 6 p, 1 fig, 7 ref, append.

Descriptors: *Sediments, *Bed load, *Deposition (Sediments), *Stratification, *Sedimentary structures, Settling velocity, Turbulence, Dunes, Particle size, Stratigraphy, Hydrogeology, Particle shape.
Identifiers: *Cross-bedding.

Qualitative and quantitative observations show a general positive correlation between grain size and thickness of cross-bedded units. Greater sand-wave height correlates with greater turbulence which permits more and coarser grains to be transported. A theory is developed which qualitatively explains these relationships. (Knapp-USGS)
W69-08711

A COMPUTER PROGRAM FOR GRAIN-SIZE DATA,
Geological Survey, Washington, D.C.; and Woods Hole Oceanographic Institution, Mass.
John Schlee, and Jacqueline Webster.
Sedimentology, Vol 8, No 1, p 45-53, Feb 1967. 9 p, 3 fig, 3 tab, 17 ref.

Descriptors: *Particle size, *Classification, *Computer programs, Data processing, Digital computers, Histograms, Sediments, Sedimentology.
Identifiers: Particle size analysis computer program.

The computer program for sedimentary particle size analysis, used by the Woods Hole Oceanographic Institution-United States Geological Survey Atlantic Continental Margin project, fits a continuous distribution to discrete data by the method of continuous parabolic interpolation. In a few samples, negative size values were computed in the tails of the distribution as a result of this interpolation. To eliminate this difficulty, an exponential interpolation was substituted whenever negative values occurred in the tails. From the interpolated size data, moment measures were then calculated to characterize the size curve. When interpolated values as well as original measurements were used, rather than original measurements alone, the moment measures more truly represent the characteristics of the size distribution. (Knapp-USGS)
W69-08712

THE PRESENTATION OF SUBJECTIVE SHAPE AND ROUNDNESS DATA,
City Univ., London (England).
I. J. Smalley.
Sedimentology, Vol 8, No 1, p 35-38, Feb 1967. 4 p, 1 fig, 5 ref.

Descriptors: *Sediments, *Particle shape, *Classification, Measurement, Dimensions, Estimating, Test procedures.
Identifiers: Particle shape calssification scheme, Zingg particle-shape classification.

If a modified version of the Zingg system is used particles can be subjectively classified into four shape classes. The roundness of a particle can be estimated by assessing the flat/convex/concave ratio and can then be represented as a point on a triangular net; this point can also indicate the Zingg class of the particle. This paper presents pertinent data and illustrates the results of a shape and roundness analysis carried out on a sample of 100 pebbles from Hythe (Kent) beach, England. (Knapp-USGS)
W69-08713

RIPPLE MARK INDICES AND THEIR USES,
Florida State Univ., Tallahassee. Dept. of Geology.
W. F. Tanner.
Sedimentology, Vol 9, No 2, p 89-104, Sept 1967. 16 p, 4 fig, 19 ref.

Descriptors: *Ripple marks, *Classification, *Sedimentary structures, Shape, Currents (Water), Waves (Water), Winds, Sand waves, Sedimentary petrology, Bed load, Dunes, Sediment transport, Shear, Turbulence.
Identifiers: Ripple-mark classification, Symmetry.

A sedimentary ripple-mark classification is presented to use in identifying sedimentary accumulation environments by measuring various aspects of ripple mark geometry. Current ripple marks are easily separated from wing, wave, and swash marks. Current ripple marks have different parallelism, symmetry, straightness, and continuity from the other types, because current marks are shaped primarily by unidirectional eddies while wind, wave, and swash marks are controlled largely by shear movement. The parameters defined for ripple identification are ripple index, ripple symmetry index, continuity index, bifurcation index, straightness index, and 2 parallelism indices. (Knapp-USGS)
W69-08714

SIMULATION OF RIVER CHANNEL DEFORMATIONS,
State Hydrological Inst., Leningrad (USSR).
K. I. Rossinskiy.
Soviet Hydrol: Selec Pap, Issue No 2, p 101-114, 1968. 14 p, 5 fig, 10 ref. Trans Trudy Gos Gidrol Inst, No 143, p 186-203, 1968.

Descriptors: *Model studies, *Hydraulic models, *Sediment transport, *Channel erosion, *Hydraulic similitude, Reynolds number, Froude number, Channel morphology.
Identifiers: USSR, Channel phenomena simulation.

The rules for simulating channel phenomena on erosible models are described, the difficulties involved are discussed, and ways of overcoming them are outlined. Channel processes cannot be reproduced exactly on soft models so that approximate simulation must be resorted to. Methods of approximate simulation depend on the specific problems to be solved. Several approaches to simulation in specific cases are described. Modeling of river channels requires hydraulic similarity of river regime, sediment movement, and channel deformation. To achieve hydraulic similarity, it is necessary to duplicate the Droude, Reynolds, Stroudal, and Euler numbers. It is practically impossible to satisfy the Froude and Reynolds conditions simultaneously. Reynolds numbers must be large enough so that, model phenomena be in the self-similarity region. (Knapp-USGS)
W69-08723

LONGITUDINAL PROFILE AND CONVEYANCE OF AN EROSIBLE RIVER CHANNEL,
State Hydrological Inst., Leningrad (USSR).
I. F. Karasev.
Soviet Hydrol: Selec Pap, Issue No 2, p 123-138, 1968. 16 p, 6 fig, 1 tab, 27 ref. Trans Trudy Gos Gidrol Inst, No 150, p 83-102, 1968.

Descriptors: *Alluvian channels, *Stage-discharge relations, *Channel erosion, *Sediment transport, Regime, Channel morphology, Streamflow, Erosion, Deposition (Sediments), Roughness (Hydraulic).
Identifiers: *USSR, Channel conveyance capacity.

Most of the hydrometric data on river regimes relate to individual cross sections at gaging stations. The basic information obtained consists of measured water discharges. Computations of channel deformations, the conveying capacity of the channel, the plotting of curves of the free surface require more than data on the hydraulic elements at a single cross section; they require knowledge of their variation along the stream. Because hydraulic data are not readily interpreted to yield channel storage, determination of channel conveyance from the discharge curve is complicated. Bottom deformation and the inconsistency of the slopes of the free surface and of hydraulic resistances, and other factors that change the character of the relationship between discharges and water levels, will be fully defined only by analysis of the channel process over a sufficiently long river reach. Calculation of the dynamic structure of nonuniform flow is necessary for determination of channel capacity and for determination of the locations of the cross section and the base line for measurement of the free surface slope. (Knapp-USGS)
W69-08727

SEDIMENT DATA FOR CANADIAN RIVERS-1966.
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.

Inland Waters Br Water Survey of Canada Basic Data Rep, 1969. 157 p, 1 map.

Descriptors: *Sediment load, *Rivers, *Suspended load, *Data collections, Sediment discharge, Sediment yield, Streamflow, Discharge (Water), Sediment transport, Stream gages, Sampling.
Identifiers: *Canada, Sediment sampling.

Data on the quantity and character of stream-transported sediment in Canada for water year 1966 are tabulated for use as a basis for studies of river channel morphology, erosion, deposition, and water resources. The sampling equipment used is described. Each sampling station record includes location of station, drainage area, type of gage, period of record, mean discharge, extremes of discharge and sediment load, history of station, remarks on record quality, and tabulated monthly mean sediment load and daily suspended load data. Particle-size analyses are included in some records. (Knapp-USGS)
W69-08746

SOIL TEXTURE PATTERNS IN THE ALLUVIUM OF THE LOWER INDUS PLAINS,
Hunting Technical Services Ltd., Boreham Wood (England).
D. A. Holmes, and S. Western.
J Soil Sci, Vol 20, No 1, p 23-37, Mar 1969. 15 p, 6 fig, 3 tab, 7 ref.

Descriptors: *Soil classifications, *Soil texture, *Alluvium, Flood plains, Soil types, Soil texture, Soil properties, Geomorphology, Soil chemistry, Deposition (Sediments).
Identifiers: *Indus plain, *Pakistan.

Soil texture was mapped in the immature alluvial soils of the Lower Indus plain. A disadvantage of soil texture as a mapping criterion in such soils is the great complexity of their textural patterns. The geomorphological background of the Lower Indus plains is examined, and a classification of texture and textural profiles is defined. The mapping unit proposed, the 'textural association', comprises a certain range of textural profiles within a given landform, related to each other by the modes of deposition which established that landform. It seems likely that the textural association could, in

more detailed surveys, form the basis of a soil series classification. (KnappdUSGS)
W69-08761

SEDIMENTARY ENVIRONMENTS AND UNCONSOLIDATED CARBONATE SEDIMENTS OF THE FRINGING CORAL REEFS OF MAHE, SEYCHELLES,
Glasgow Univ. (Scotland). Dept. of Geology.
Michael Samuel Lewis.
Marine Geol, Vol 7, No 2, p 95-127, Apr 1969. 33 p, 14 fig, 37 ref.

Descriptors: *Sedimentation, *Coral, *Reefs, *Calcium carbonate, Sedimentology, Marine animals, Provenance, Sediment transport, Deposition (Sediments), Currents (Water), Waves (Water), Particle size, Turbulence, Channels, Sands.
Identifiers: Seychelles Islands.

Extensive fringing coral reefs occur around Mahe, the largest island in the Seychelles Archipelago. Several sedimentary environments, which are best developed on reefs exposed to the Southeast Monsoon (the dominant wind), are associated with the reefs. These are the beach, rippled sand zone, marine grass bed, radial zone, algal ridge, reef edge, reef slope, 'plateau', mangrove and former mangrove swamps, deltas, channels, and the fore-reef environment. Skeletal carbonate sands form a veneer on the reef flats and are widespread in the fore-reef environment. Locally they pass into quartz sands. Current transportation is dominantly landward, with little material being carried from the reef flats into the fore-reef and channel environments. It is often difficult to relate the grain-size measures of the sediments to their environment of deposition. The turbulent conditions in the beach, algal ridge and reef edge environments are reflected in the absence of fine material and the low dispersion values of the associated sediments. Grass bed samples have high dispersion values and are relatively rich in fines trapped by the grasses. Radial zone samples show much variation in grain-size measures due to the diversity of the conditions of deposition. The skewness in mangrove swamp sediments is positive, indicating normal current deposition. Sheltered fore-reef deposits tend to be rich in fines and to have positive skewness values due to the quiet conditions, whereas fine material is winnowed from windward fore-reef sediments. (Knapp-USGS)
W69-08766

EROSION.
For primary bibliographic entry see Field 06E.
W69-08790

GRAIN-SIZE INDICES, CLASSIFICATION AND ENVIRONMENT,
Agricultural Univ., Wageningen (Netherlands). Dept. of Regional Soil Science.
D. J. Doeglas.
Sedimentology, Vol 10, No 2, p 83-100, Mar 1968. 18 p, 12 fig, 1 tab, 11 ref.

Descriptors: *Sedimentology, *Particle size, *Classification, *Statistical methods, Sedimentation, Sands, Silts, Clays, Sediments, Provenance, Sediment transport.
Identifiers: *Wentworth sediment classification.

Indices based on Wentworth phi values are proposed for textural classification of sediments. The indices, and to a smaller degree the names, show sorting and skewness based on integer phi units. The classification scheme gives a continuous scale from gravel to fine clay, and the indices can be used for distinction of river, marine, and loess deposits. The addition of indices of the 1st and 99th percentile, giving 5-digit indices, augments the possibilities for a determination of the environment; river deposits can be distinguished from beach and dune sediments and in more detail from shallow marine and coastal deposits. The indices can be handled by data-processing machines. (Knapp-USGS)
W69-08905

SOME HYDRAULIC PROPERTIES OF BIOCLASTIC CARBONATE GRAINS,
Calgary Univ. (Alberta). Dept. of Geology.
W. R. Maiklem.
Sedimentology, Vol 10, No 2, p 101-109, Mar 1968. 9 p, 4 fig, 11 ref.

Descriptors: *Sediments, *Settling velocity, *Sediment transport, *Carbonates, *Particle shape, Suspension, Tractive forces, Particle size, Carbonate rocks, Coral, Algae, Sands, Gravels.
Identifiers: Carbonate grains, Bioclastics.

A simple experiment demonstrates that shape and bulk density of bioclastic carbonate grains are important factors affecting the grain-size distribution of a clastic carbonate sediment deposited in water. Settling velocities of bioclastic carbonate grains divided into shape groups--blocks, rods, spheres, and plates--have been compared to calculated settling velocities of calcite and aragonite. It was found that calculated settling velocities are up to 4 times greater than actual velocities. Block-shaped grains (coral and coralline algae) show the least differences; calculated velocities are as much as half greater for fine to medium sand grains but the same for gravel. Plate shaped grains of the foraminifera Marginopora have the largest differences; calculated velocities are about twice greater for sand and about 4 times greater for pebbles. The differences in settling velocities can be accounted for by shape, bulk density, and settling motion. Settling motion, in turn, is related to shape. (Knapp-USGS)
W69-08906

EFFECTS OF SUSPENDED MATERIAL ON WATER QUALITY,
Kansas Univ., Lawrence. Dept. of Civil Engineering; and Kansas State Geological Survey, Lawrence.
For primary bibliographic entry see Field 02K.
W69-08915

RELATIONS BETWEEN SUSPENDED MATTER AND SALINITY IN ESTUARIES OF THE ATLANTIC SEABOARD, U.S.A.,
Geological Survey, Woods Hole, Mass.
For primary bibliographic entry see Field 02K.
W69-08916

A COASTAL POND STUDIED BY OCEANOGRAPHIC METHODS,
Woods Hole Oceanographic Institution, Mass.
For primary bibliographic entry see Field 02H.
W69-08922

ERRORS IN USING MODERN STREAM-LOAD DATA TO ESTIMATE NATURAL RATES OF DENUDATION,
Geological Survey, Woods Hole, Mass.
Robert H. Meade.
Geol Soc Amer Bull, Vol 80, p 1265-1274, July 1969. 10 p, 9 fig, 56 ref.

Descriptors: *Sediment load, *Erosion, Rivers, Cultivated lands, Sedimentation, Silting, Aggradation, Provenance, Sediment distribution, Sediment yield.
Identifiers: Potomac River, Eastern U.S., Denudation rates.

The practice of calculating natural rates of denudation from routinely collected data on the loads of suspended and dissolved matter in modern rivers is subject to several significant errors. The sources of these errors are demonstrated by examples from the Atlantic drainage of the United States, where their total effect has apparently doubled the natural rate of erosion. The largest error is caused by assuming that modern sediment loads in populated areas represent natural erosion, whereas in fact they mainly reflect the influence of man. Conversion of forests to croplands in the middle Atlantic states causes about a 10-fold increase in sediment yield. Coal mining, urbanization, and highway construction have added extra loads of sediment to the streams. Modern sediment loads in the Atlantic-draining rivers are probably 4 to 5 times greater than they would be if the area had remained undisturbed by man. Errors in calculating the chemical denudation are caused by atmospheric contributions to the dissolved loads of streams and by pollutants that are added directly to stream waters. About 1/4 of the salts in Atlantic-draining streams were contributed from the atmosphere, either as recycled sea salts or as pollutants and soil dust that originally became airborne as a result of the activities of man. Perhaps another 1/10 of the dissolved load consists of industrial and agricultural wastes or acid mine waters that have been added directly to the streams. (Knapp-USGS)
W69-08939

GLOSSARY OF TERMS USED IN FLUVIAL, DELTAIC, AND COASTAL MORPHOLOGY AND PROCESSES.
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.

Louisiana State Univ Coastal Studies Inst Tech Rep No 63, Dec 15, 1968. 97 p. Richard J. Russell, Editor. Task Order No NR388022 ONR. Project No Nonr 1575 (03)ONR.

Descriptors: *Geomorphology, *Coasts, *Streams, *Deltas, Sedimentation, Erosion, Land farming, Topography.
Identifiers: *Glossary.

A glossary of terms used in fluvial, deltaic and coastal morphology studies was compiled by the Coastal Studies Institute of Louisiana State University as a project of Office of Naval Research. (Knapp-USGS)
W69-08940

2K. Chemical Processes

A GREENHOUSE STUDY OF RELATIONS BETWEEN NUTRIENT MOVEMENT AND CONVERSION IN A SANDY SOIL AND THE NUTRITION OF SLASH PINE SEEDLINGS,
Forest Service (USDA), Olustee, Fla. Southeastern Forest Experiment Station; and Yale Univ., New Haven, Conn. School of Forestry.
George W. Bengtson, and Garth K. Voigt.
Proc Soil Sci Society of America, Vol 26, p 609-612, 1962. 3 tab, 14 ref, disc.

Descriptors: *Lysimeter, *Fertilizers, *Cycling nutrients, Leaching, Water treatment, Urea, Transpiration.
Identifiers: Slash pine, Potassium-calcium pyrophosphate, Ammonium nitrate, Potassium chloride, Loss of nutrients.

A greenhouse lysimeter study was made of the stability of different nitrogen-phosphorus-potassium fertilizers against their removal by leaching and the availability of nutrient elements to slash pine seedlings growing in Lakeland fine sand. Leachate analyses showed that nearly all ammonium nitrate and potassium chloride applied to surface soil in bare lysimeters were leached from the upper 12 inches within four weeks when water was applied at the rate of 4 inches per week. At the same watering rate, urea-formaldehyde and potassium calcium pyrophosphate showed substantially lower leaching losses. The growth of pine seedlings prevented or reduced leaching of nitrogen and potassium at watering levels of 1 and 2 inches per week, but at a watering rate of 4 inches per week, the seedlings were relatively ineffective in reducing nutrient losses. Fertilized seedlings transpired from 30 to 80% more water than the controls, yet their water use per gram of dry matter produced was 25 to 50% less than that of unfertilized seedlings. (Wilde-Wis)
W69-08676

CLATHRATE HYDRATES OF AIR IN ANTARCTIC ICE,
California Univ., San Diego, La Jolla. Dept. of Chemistry.
Stanley L. Miller.
Science, Vol 165, No 3892, p 489-490, Aug 1969. 2 p, 1 fig, 15 ref.

Descriptors: *Clathrates, *Ice, *Glaciers, *Antarctic, *Hydrate processes, Air, Hydrates, Oxygen, Nitrogen, Bubbles, Solubility.
Identifiers: Antarctic ice bubbles.

Measurements of the dissociation pressure of nitrogen hydrate and oxygen hydrate show that a clathrate hydrate of air should exist below about 800 meters in the Antarctic ice sheet. This accounts for the disappearance of gas bubbles at depths greater than 1200 m. The hydrate should exist from this depth to the bottom of the core and should constitute 0.06% of the ice. (Knapp-USGS)
W69-08695

THERMODYNAMICS OF HYDROTHERMAL SYSTEMS AT ELEVATED TEMPERATURES AND PRESSURES,
Northwestern Univ., Evanston, Ill. Dept. of Geology.
Harold C. Helgeson.
Amer J Sci, Vol 267, No 7, p 729-804, Summer 1969. 76 p, 21 fig, 14 tab, 162 ref.

Descriptors: *Water chemistry, *Aqueous solutions, *Chemical potential, *Chemical reactions, *Geochemistry, Mineralogy, Thermodynamics, Saline water systems, Thermodynamic behavior.
Identifiers: *Hydrothermal reactions, Hydrothermal ore deposits.

Chemical relations in hydrothermal systems can be described in terms of the thermodynamic properties of minerals, aqueous species, gases, and concentrated sodium chloride solutions. Sufficient thermodynamic data are available to permit calculation of equilibrium constants for a large number of hydrothermal reactions at high temperatures and pressures. Where these data are incomplete, the calculations involve entropy estimates, application of average heat capacities, and/or assumptions concerning the temperature dependence of thermodynamic variables and the relative importance of electrostatic and non-electrostatic interaction among the aqueous species in hydrothermal solutions. High temperature stoichiometric activity coefficients for individual ions can be calculated using deviation functions computed from osmotic coefficients for concentrated sodium chloride solutions. The results of such calculations, together with computed heat capacities, enthalpies, entropies, and equilibrium constants for many hydrothermal species and reactions at high temperatures are presented in tables and diagrams. The methods, assumptions, and equations employed in the calculations are summarized in general notation. The numerical information contained in the tables permits calculation of the solubilities of silicates, sulfides, carbonates, sulfates, and oxides in multicomponent hydrothermal solutions containing high concentrations of sodium chloride at elevated temperatures, and evaluation of the mass transfer accompanying irreversible reactions responsible for metasomatism and ore deposition in hydrothermal systems. (Knapp-USGS)
W69-08698

THE COURSE OF SELF-PURIFICATION PROCESS OF CANALIZED, HIGHLY POLLUTED RIVERS,
H. Manzack.
Water Res, Vol 2, No 1, p 3-4, Jan 1968. 2 p.

Descriptors: *Self-purification, *Channeling, *Stream pollution, *Water quality, Biochemical oxygen demand, Dissolved oxygen, Reaeration, Navigable river, Aerobic conditions, Anaerobic conditions, Weirs.
Identifiers: *Poland, *Odra River, Self-purification process.

A study to establish the capacity of self-purification in channeled and unchanneled sections of Odra River, Poland is described. Hydrographic, hydrometric, chemical and biological measurements in the river showed: (1) Ice cover reduced the biochemical processes; (2) The coefficient of oxygen utilization in polluted water was about half that from unpolluted water; (3) This coefficient decreased sharply during the navigable period; (4) The reaeration process was much lower in channeled sections of the river than in unchanneled sections; (5) The self purification capacity was relatively high in unchanneled sections, without ice; (6) The self purification coefficient decreased in polluted water during summer and autumn only in the areas with high initial BOD values. It is concluded that canalization of Odra River has positive and negative features, of which the weirs which increase the amount of dissolved oxygen is the most important. The channel has negative effects such as accumulation of bottom sediment, hydrogen sulphide and occurrence of oxygen defficiency. (Carstea-USGS)
W69-08703

DETERMINATION OF GOLD IN WATERS IN THE NANOGRAM RANGE BY ANION EXCHANGE AND ATOMIC ABSORPTION SPECTROPHOTOMETRY,
Geological Survey, Denver, Colo.
T. T. Chao.
Econ Geol, Vol 64, No 3, p 287-290, May 1969. 4 p, 4 fig, 1 tab, 7 ref.

Descriptors: *Water chemistry, *Analytical techniques, *Chemical analysis, *Trace elements, *Gold, Ion exchange, Spectrophotometry, Anion exchange.
Identifiers: Atomic absorption spectrophotometry.

A method has been developed whereby nanogram amounts of gold in waters can be accurately determined. The development of the method involves determination of optimum conditions for the complete recovery of gold from water using an anion exchange resin column, quantitative elution of gold from the resin, and final measurement of gold by atomic absorption spectrophotometry following MIBK (methyl isobutyl ketone) extraction of gold from a nitric acid solution. (Knapp-USGS)
W69-08706

COMPOSITIONAL SIMILARITIES BETWEEN HOT MINERAL SPRINGS IN THE JORDAN AND SUEZ RIFT VALLEYS,
Israel Atomic Energy Commission, Rehovoth; and Weizmann Inst. of Science, Rehovoth (Israel).
Emanuel Mazor.
Nature, Vol 219, No 5153, p 477-478, Aug 3, 1968. 2 p, 2 fig, 7 ref.

Descriptors: *Hot springs, *Water chemistry, *Mineral water, Seawater, Mixing, Groundwater, Chemical reactions, Thermal water, Aqueous solutions, Geochemistry, Saline water systems.
Identifiers: *Israel, Dead Sea, Red Sea, Lake Tiberias, Tiberias hot spring, Hamman Farun hot spring.

The chemical composition of water from Hammam Farun hot spring in the Suez Rift Valley, Israel is almost identical to that of waters from Tiberias hot springs in the Jordan Rift Valley. Springs in the rift valleys have very similar waters although their source rocks and structural geology are not similar. It has been suggested that in the geological past, seawater flooded the rift valleys and infiltrated the tectonically shattered rocks, and reaction of the trapped seawater with host rocks and native groundwater produced the present spring water. Finding similar water in springs of another rift valley supports the suggestion. Experiments on sea water mixed with rock samples resulted in formation of waters similar to the spring waters, which are depleted in Mg and Na, and enriched in Ca, Sr, Li, Br, sulfate, and Ra, relative to seawater. (Knapp-USGS)
W69-08709

DILUTE SOLUTION REACTIONS OF THE NITRATE ION AS APPLIED TO WATER RECLAMATION,
Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio. Cincinnati Water Research Lab.
For primary bibliographic entry see Field 05D.
W69-08715

MATHEMATICAL MODELS FOR THE DISPERSION OF RADIONUCLIDES IN AQUATIC SYSTEMS,
Texas Univ., Austin. Environmental Health Engineering Research Lab.
For primary bibliographic entry see Field 02E.
W69-08739

MEASUREMENTS OF BACKGROUND RADIATION IN AQUATIC HABITATS IN ALASKA,
Dartmouth Coll., Hanover, N. H. Dept of Biological Sciences; and Army Terrestrial Sciences Center, N.H.
For primary bibliographic entry see Field 02E.
W69-08740

FORTRAN IV PROGRAM FOR SYNTHESIS AND PLOTTING OF WATER-QUALITY DATA,
Geological Survey, St. Paul, Minn.; and Geological Survey, Lawrence, Kans. Water Resources Div.
For primary bibliographic entry see Field 07C.
W69-08749

SULPHATE REDUCTION IN WATERLOGGED SOILS,
Rothamsted Experimental Station, Harpenden (England).
C. Bloomfield.
J Soil Sci, Vol 20, No 1, p 207-221, Mar 1969. 15 p, 8 fig, 3 tab, 35 ref.

Descriptors: *Saturated soils, *Sulfates, *Water chemistry, *Biodegradation, *Sulfur bacteria, Anaerobic bacteria, Sulfides, Hydrogen sulfide, Organic matter.
Identifiers: Sulfate reduction, Desulfovibrio.

To study the factors that influence the release of free hydrogen sulfide, flooded soils were incubated with plant material and either sodium sulphate or elemental sulfur. Residual sulphate, FeS and hydrogen sulfide were measured throughout the reaction. Less free hydrogen sulfide was evolved from a periodically waterlogged soil than from a well-drained soil comparable HCl- and dithionite-soluble Fe content. With a readily soluble synthetic iron oxide as the source Fe, a slight excess of Fe over the sulfate-equivalent sufficed to prevent loss of hydrogen sulfide. The native organic matter in the well-drained Rothamsted top-soil seemed to have no effect in promoting loss of hydrogen sulfide, but the FeS: hydrogen sulfide ratio was strongly influenced by the nature of the plant material used as the source of energy. With either sodium sulfate or S, considerably more free hydrogen sulfide was evolved with lucerne than with rice blade. With S, the pH of the incubated mixtures was close to that of the nominally S-free system, whereas with sodium sulfate the mixture became quite alkaline. More free hydrogen sulfide was evolved under the more alkaline conditions obtained with sodium sulfate, which suggests that it is the initial mobilization of Fe that governs the distribution of the reduced S, rather than the pH-solubility relations of FeS. An oxidized surface layer is very effective in retaining sulphur in the soil. (Knapp-USGS)
W69-08754

THE EFFECT OF THE CONCENTRATION AND MOVEMENT OF SOLUTIONS ON THE SWELLING, DISPERSION, AND MOVEMENT OF CLAY IN SALINE AND ALKALI SOILS,
Reading Univ. (England). Dept. of Soil Science.
For primary bibliographic entry see Field 02G.
W69-08755

BEHAVIOR OF ORGANIC CHEMICALS IN THE AQUATIC ENVIRONMENT. PART 2-BEHAVIOR IN DILUTE SYSTEMS,
Washington Univ., St. Louis, Mo. Environmental and Sanitation Engineering Lab.
For primary bibliographic entry see Field 05C.
W69-08767

SOME LEGAL AND ECONOMIC IMPLICATIONS OF SEA WATER INTRUSION--A CASE STUDY OF GROUND WATER MANAGEMENT,
California Univ., Davis. Dept. of Agricultural Economics; and California Univ., Davis. Water Resources Center.
Charles V. Moore, and J. Herbert Snyder.
Natur Resources J, Vol 9, No 3, p 401-419, July 1969. 19 p, 2 fig, 1 tab, 26 ref.

Descriptors: *Saline water intrusion, *Aquifers, *California, *Legal aspects, *Economics, Saline water systems, Artificial recharge, Pumping, Irrigation water, Canals, Water rights, Water law, Social aspects, Property values, Water supply, Water costs.
Identifiers: *Salinas Valley (Calif).

The Salinas Valley, an intensively cultivated coastal valley about 130 mi south of San Francisco, is noted for its summer vegetable production. The irrigation water supply necessary for intensive crop production comes from pumping an underground basin recharged by percolation from the Salinas River which flows through the Valley. Degradation of groundwater quality by saltwater intrusion has forced abandonment of wells near the coast. A geological survey of Monterey Bay indicates the presence of silt, sand, and gravel. A gravelly outcrop located in submarine canyon walls is probably the 180-ft aquifer. When legal alternatives are analyzed within both the framework of welfare economics and the legal setting of property rights, the threat of court action by the injured parties causes a change away from the present status quo solution to one with which the pumpers in the uncontaminated area would be better off if they contributed to the cost of a fresh water canal rather than suffer the consequences and costs of having the courts adjudicate groundwater damages. The aggregate profit level of the entire pressure area would be maximized under this solution. (Knapp-USGS)
W69-08768

WATER SALINITY PROBLEMS: APPROACHES TO LEGAL AND ENGINEERING SOLUTIONS,
Beardsley, Hufstedler and Kemble, Los Angeles, Calif.; and Colorado River Board of California, Los Angeles.
Burton J. Gindler, and Myron B. Holburt.
Natur Resources J, Vol 9, No 3, p 329-400, July 1969. 71 p, 4 fig, 298 ref.

Descriptors: *Saline water intrusion, *Salinity, *Saline water systems, *Desalination, *Legal aspects, *Economics, Artificial recharge, Pumping, Water rights, Water law, Social aspects, Property values, Cost-benefit analysis, Arid lands.
Identifiers: Salinity control agencies.

Salinity problems in the arid Western U.S. and both legal and engineering approaches to their solutions are discussed for reference use by the legal profession. The determination of desirable salinity levels requires consideration of complex legal, cost and benefit, and engineering factors. Costs should recognize valid water rights. The California Water Plan is used to illustrate economic, legal, and engineering evaluations of salinity effects, control, and treatment. The use of static, dynamic, and recharge salinity barriers to prevent saline water intrusion is discussed. The organization of regional agencies is necessary to administer most salinity control undertakings. (Knapp-USGS)
W69-08769

INTERPRETATION OF THE RESULTS OF HYDROGEOCHEMICAL PROSPECTING (RUSSIAN),
For primary bibliographic entry see Field 02F.
W69-08771

CATIONS AND SILICA IN NATURAL WATERS: CONTROL BY SILICATE MINERALS,
Johns Hopkins Univ., Baltimore, Md.
Owen P. Bricker.
Symp on Geochem, Precipitation, Evaporation, Soil-Moisture, Hydrom, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 78, p 110-119, 1968. 10 p, 9 fig, 2 tab, 7 ref.

Descriptors: *Water chemistry, *Streams, *Chemical reactions, *Equilibrium, Leaching, Solutes, Aqueous solutions, Weathering, Mineralogy, Silicates.
Identifiers: *Silicate-water equilibria.

Reactions of water and silicate minerals control the composition of natural groundwater and surface waters. Silicate-water systems react at measurable rates in the laboratory and the final water composition is determined by the solid phases present in the system. In the natural system investigated, a small wooded watershed near Baltimore, Md., the major portion of the dissolved load of the stream is derived from rock weathering. Carbon dioxide-charged rain reacts rapidly with the silicate minerals in the bedrock and soil, producing solids more aluminous than the original silicates; the solution is enriched in dissolved silica, cations and bicarbonate ion. Aluminum is conserved in the solid phase. Most of the dissolved silica in the stream is derived from the breakdown of oligoclase feldspar even though quartz is the major silica mineral in the rock. The reaction of water with silicates is so rapid that the waters remain in near-equilibrium with one or more solid phases at all times. In this watershed the rate of removal of material as dissolved load is about 5 times greater than the rate of mechanical removal. (Knapp-USGS)
W69-08914

EFFECTS OF SUSPENDED MATERIAL ON WATER QUALITY,
Kansas Univ., Lawrence. Dept. of Civil Engineering; and Kansas State Geological Survey, Lawrence.
Ernest E. Angino, and Walter J. O'Brien.
Symp on Geochem, Precipitation, Evaporation, Soil-Moisture, Hydrom, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 78, p 120-128, 1968. 9 p, 5 fig, 17 ref.

Descriptors: *Suspended load, *Water quality, Water chemistry, Equilibrium, Aqueous solutions, Turbidity, Hardness (Water), Color, Odor, Taste, Photosynthesis, Aquatic life, Adsorption, Absorption, Sediments, Dissolved oxygen.
Identifiers: Suspended contaminants (Water).

Some of the effects of suspended load on stream water quality are summarized. The suspended material contributes to turbidity, hardness, alkalinity, water color, affects photosynthetic activity, and may be harmful to some organisms. In obstructing the penetration of light it induces a reduction in photosynthesis and indirectly causes a change in the oxygen content of the stream. The suspended load may act as substrate for bacteria, fungi, and other microorganisms as well as influence the concentration of certain compounds by sorption. Study of the suspended load of rivers draining the Cretaceous chalk terrain of Western Kansas showed that at certain times of the year a large part of the load is calcite. At other times considerable amounts of quartz, clays, and organic debris make up the river load. The calcite was a clearly identified component in transported sediments of the Kansas River as much as 150 mi east of the eastern limit of Cretaceous outcrops. Considering the solubility of calcite, any solution of the suspended calcite influences the Ca, Mg, pH, and bicarbonate values of these streams and thereby stream hardness. A relatively constant K and Mg content suggests a possible positive control by exchange reactions with the clayload of the streams. Similar affects on the nitrate, phosphate, and possibly sulfate concentration are to be expected from seasonal changes in the organic content of streams. Presently we know few of the detailed mechanisms by which suspended material has any effect on the water quality of the water carrying it. (Knapp-USGS)
W69-08915

RELATIONS BETWEEN SUSPENDED MATTER AND SALINITY IN ESTUARIES OF THE ATLANTIC SEABOARD, U.S.A.,
Geological Survey, Woods Hole, Mass.
Robert H. Meade.
Symp on Geochem, Precipitation, Evaporation, Soil-Moisture, Hydrom, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 78, p 96-109, 1968. 14 p, 10 fig, 2 tab, 34 ref.

Descriptors: *Suspended load, *Salinity, *Estuaries, *Atlantic coastal plain, Delaware River, Silts, Clays, Saline water-freshwater interfaces, Chemical precipitation, Flocculation, Water chemistry, Turbulence, Currents (Water), Tides.
Identifiers: Potomac River, Chesapeake Bay.

Despite the suggestion by laboratory experiments that suspended matter in rivers is flocculated and deposited where it reaches saltwater, the concentrations of suspended matter in estuaries associated with some moderately large rivers of the Atlantic seaboard show no accelerated decrease that can be attributed to salt flocculation. Velocities of the estuarine waters are apparently sufficient to obscure the expected effects of salinity and keep the material in suspension. The general decrease in suspended matter associated with increasing salinity in the seaward direction can be attributed to the simple dilution of river suspensions by seawater. Superimposed on the general seaward decrease in suspended concentration is a maximum concentration near the upstream limit of sea salt. Suspended concentrations decrease both upstream and downstream of the maximum. This maximum has been found at one time or another in all the estuaries that have been sufficiently studied. It seems to reflect the accumulation of suspended matter near the salt limit by net landward flow along the estuary bottom. (Knapp-USGS)
W69-08916

GRAPHICAL METHODS FOR STUDY OF DISSOLVED ALUMINUM COMPLEXES,
Geological Survey, Washington, D.C.
John D. Hem.
Symp on Geochem, Precipitation, Evaporation, Soil-Moisture, Hydrom, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 78, p 15-23, 1968. 9 p, 5 fig, 9 ref.

Descriptors: *Water chemistry, *Aluminum, *Ions, Fluorides, Sulfates, Chemical potential, Chemical reactions, Geochemistry, Hydrogen ion concentration, Aqueous solutions.
Identifiers: Aluminum ions.

The distribution of ionic species in dilute solutions at 25 deg C and 1 atmosphere pressure can be computed by mathematical procedures based on the law of mass action and related thermodynamic equations. The computations require some knowledge of concentrations of ions and the forms of complexes or ion-pairs, and their stability constants, or their free energies of formation. Sufficient information is now available to permit accurate computations of the amount and form of dissolved species of many constituents of natural water. Graphs can be prepared which give relatively simple and direct insights into the details of natural water chemistry. Examples show the solubility of aluminum in relation to pH, the dominant dissolved forms of aluminum in solutions containing various concentrations of fluoride, and the propor-

tions of uncomplexed to total dissolved aluminum in such solutions. Graphs also are given showing the interrelated complexing effects of fluoride and sulfate and fluoride and hydroxide. (Knapp-USGS)
W69-08917

RESEARCH ON GROUND-WATER CONTAMINATED BY DEPOSITS OF SOLID WASTE,
Hessiches Landesamt fuer Bodenforschung, Wiesbaden (West Germany).
For primary bibliographic entry see Field 05B.
W69-08918

SOME QUESTIONS CONCERNING GEOCHEMICAL HYDRODYNAMICS,
All-Union Scientific Research Inst. of Hydrogeology and Engineering Geology, Moscow (USSR).
N. N. Verigin, and B. S. Sherzhukov.
Symp on Geochem, Precipitation, Evaporation, Soil-Moisture, Hydrom, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 78, p 42-53, 1968. 12 p, 28 ref.

Descriptors: *Water chemistry, *Diffusion, *Dispersion, *Groundwater movement, Ion exchange, Mass transfer, Convection, Flow, Mixing, Density, Ion transport, Osmosis, Soil moisture, Soil water.
Identifiers: Geochemical hydrodynamics.

The migration and diffusion of solutes in moving groundwater and the mass transfer of ions between groundwater and rock minerals are discussed. Diffusion and sorption equations are derived theoretically and their solutions are compared with the results of field observations. Equations are given for 2-dimensional convective diffusion, sorption, flow of miscible fluids, solution at surfaces, and ion exchange. (Knapp-USGS)
W69-08919

DISSOLVED MATTER DISCHARGE AND MECHANICAL AND CHEMICAL EROSION,
Gidrometeorologicheskii Institut, Leningrad (USSR).
O. A. Alekin, and L. V. Brazhnikova.
Symp Geochem, Precipitation, Evaporation, Soil-Moisture, Hydrom, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 78, p 35-41, 1968. 8 p, 4 tab, 10 ref.

Descriptors: *Dissolved solids, *Salts, *Water chemistry, . *Weathering, Aqueous solutions, Solutes, Sediment load, Geochemistry.
Identifiers: *USSR, Chemical weathering.

The total quantity of salts discharged from rivers of the USSR is computed and compared to the total world discharge of salts. From the composition and amount of salt discharge, the amount of weathering is calculated. The world's yearly discharge of sediments is estimated to be 19,700 million tons, and of dissolved solids, 2,500 million tons. Calculated dissolved loads of river basins of the USSR and continental totals for the rest of the world are tabulated. (Knapp-USGS)
W69-08920

WATER ANALYSIS,
Geological Survey, Denver, Colo.
M. J. Fishman, and B. P. Robinson.
Anal Chem Annu Rev, Vol 41, No 5, p 323R-360R, Apr 1969. 38 p, 664 ref.

Descriptors: *Reviews, *Bibliographies, *Water analysis, *Chemical analysis, Solutes, Ions, Pesticides, Dissolved oxygen, Detergents, Organic matter, Radioisotopes, Stable isotopes, Trace elements.
Identifiers: Dissolved gases, Water analysis review.

Literature on water chemical analysis published between October 1966 and September 1968 is reviewed. The review includes a list of other reviews made in the period covered. Water analysis is subdivided into classes of constituents analyzed, and includes pesticides, oxygen, gases, detergents, organics, radioisotopes, and stable isotopes as well as common and trace ionic solutes. A bibliography of 664 entries is divided into the same classes as the text, and the entries in each class are alphabetically listed by author's name. (Knapp-USGS)
W69-08942

QUALITY OF SURFACE WATERS FOR IRRIGATION IN WESTERN STATES -- 1965.
Geological Survey, Washington, D.C.

Geol Surv Water-Supply Pap 1967, 1969. 148 p, 2 fig, 1 plate, 13 ref.

Descriptors: *Water quality, *Irrigation water, *Data collections, Water analysis, Surface waters, Salinity, Salt balance, Water chemistry, Water resources.
Identifiers: Irrigation water quality, Western U.S.

Water chemical quality data from 72 irrigation network stations west of the Mississippi River are presented. Each record includes location, a list of available records, extremes, runoff, silica, Ca, Mg, Na, K, bicarbonate, carbonate, sulfate, Cl, F, nitrate, B, total solids, %Na, SAR, specific conductance, and pH. (Knapp-USGS)
W69-08956

THE EFFECT OF CATION-EXCHANGE CAPACITY ON THE RETENTION OF DIQUAT AND PARAQUAT BY THREE-LAYER TYPE CLAY MINERALS: 2. PLANT AVAILABILITY OF PARAQUAT,
North Carolina Agricultural Experiment Station, Raleigh.
For primary bibliographic entry see Field 05B.
W69-08957

ADSORPTION AND DESORPTION OF INORGANIC PHOSPHORUS BY LAKE SEDIMENTS IN A 0.1 MOLAR SODIUM CHLORIDE SYSTEM,
Wisconsin Univ., Madison.
For primary bibliographic entry see Field 05C.
W69-09014

2L. Estuaries

ON THE REFLEXION OF WAVE CHARACTERISTICS FROM ROUGH SURFACES,
Oregon State Univ., Corvallis.
For primary bibliographic entry see Field 08B.
W69-08717

RICE HOPE PLANTATION V SOUTH CAROLINA PUBLIC SERV AUTHORITY (DAMAGE FROM SALT WATER INFILTRATION AS A TAKING).
For primary bibliographic entry see Field 06E.
W69-08776

RELATIONS BETWEEN SUSPENDED MATTER AND SALINITY IN ESTUARIES OF THE ATLANTIC SEABOARD, U.S.A.,
Geological Survey, Woods Hole, Mass.
For primary bibliographic entry see Field 02K.
W69-08916

GLOSSARY OF TERMS USED IN FLUVIAL, DELTAIC, AND COASTAL MORPHOLOGY AND PROCESSES.
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
For primary bibliographic entry see Field 02J.
W69-08940

03. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

A REVIEW OF DESALINATION PROCESSES AND PRODUCT WATER COSTS,
Office of Saline Water, Washington, D.C.
W. F. Savage.
Pap, Fiftieth Annu Meet Amer Geophys Union, Apr 1969. 18 p, 7 fig.

Descriptors: *Desalination, *Desalination processes, *Water costs, Brackish water, Saline water, Brine disposal, Runoff, Technology, Water treatment, Economics, Water reuse, Water quality, Distillation, *Water requirements, Membrane processes, Reverse osmosis, Electrodialysis, Crystallization.
Identifiers: Salt removal, Water quantities.

Reviewing water requirements of the US through the first 20 yr of the next century shows that withdrawal uses in the 48 contiguous states will exceed the mean annual natural runoff. Four methods of supplying future water needs are: (1) constructing dams and aqueducts for diverting streams and rivers to areas of greatest need, (2) weather modification for increasing natural runoff, (3) reusing waste water, and (4) desalting ocean or brackish water. Desalination is reviewed, with emphasis on processes presently in use, plant sizes, and costs of water produced by each process. The technology for large plants is available, but additional research and development must be conducted for obtaining the projected decreases in product water costs and achieving widespread acceptance of desalting as a major means of solving our water problems on an economical basis. Seawater desalting costs for a range of plant sizes are represented graphically. (USBR)
W69-08866

NEED FOR SALINE GROUNDWATER DATA TO ADVANCE DESALTING TECHNOLOGY,
Office of Saline Water, Washington, D. C.
W. W. Rinne.
Pap, Fiftieth Annu Meet Amer Geophys Union, Apr 1969. 14 p, 1 fig, 3 tab, 10 ref.

Descriptors: *Demineralization, Desalination plants, Water resources, Water quality, *Brine disposal, Pre-treatment (Water), Water treatment, Chemical properties, Water sources, Arid lands, Injection wells, Water costs, Brackish water, *Groundwater geology, Aquifer characteristics, Economics, Sludge disposal, Saline water.
Identifiers: *Water quantities, *Groundwater quality, *Groundwater hydrology, Groundwater sources, Evaporation reservoirs.

A lack of specific information exists on saline water aquifers in the water-short areas of the U S. Further advances in desalting technology for brackish water applications emphasize the need for data on the chemical composition and availability of saline ground-water supplies. The desalting process to be used at a given location will be determined by the quality and quantity of available brackish waters. Waste brine disposal is one of the more urgent problems in the desalting process development. Solar evaporation ponds and deep-well injection are the preferred disposal methods at inland locations. Although evaporation ponds are a good stopgap method, deep-well injection provides a better method for ultimate waste brine disposal. Should deep-well injection prove successful, more data will be needed on geological and hydrological features of subsurface formations. Consideration must be given to the complete desalting plant system with relation to intake and brine disposal facilities in achieving optimum system economics. (USBR)
W69-08867

COMPARATIVE COST EVALUATION OF DESALTED WATER SUPPLY VERSUS ALTERNATIVE FRESH WATER SUPPLY FROM A CONVENTIONAL SOURCE,
Texas Water Development Board, Austin.
Donald E. Morris.
Pap, Fiftieth Annu Meet Amer Geophys Union, Apr 1969. 20 p, 5 fig, 5 ref.

Descriptors: *Demineralization, Desalination plants, Water resources, *Cost comparisons, *Water supply systems, Water quality, Water wells, Pipelines, Pumping plants, Pre-treatment (Water), Brine disposal, Water treatment, Economic justification, Chemical properties, Water sources, Maintenance, Amortization, Capital costs, Operating costs.
Identifiers: Water quantities, *Texas Water Development Board, Texas Water Plan.

A costing procedure was developed during desalting studies in Texas, for comparing the cost of a water supply produced by saline water conversion against the cost of providing a fresh water supply from a conventional source. For desalting, the elements included in the costing procedure were: (1) well fields for saline feedwater supply; (2) an intake system and pumping station; (3) pipelines; (4) pretreatment for saline water; (5) a desalting plant; and (6) brine disposal. For a conventional water supply system, the elements of cost included: (1) raw water cost; (2) a well field or intake system; (3) pipelines and pumping stations; and (4) a conventional water treatment plant. The final economic justification of a desalting project may include: chemical quality comparisons, secondary benefits, and projected life comparisons with future availability of alternative supplies. The Texas Water Development Board considers desalting a very practical solution to the interim water supply problems that exist in many areas of the state. (USBR)
W69-08868

3. Water Yield Improvement

ESTIMATING PROBABILITIES OF RESEARCH SUCCESS IN THE ATMOSPHERIC SCIENCES: RESULTS OF A PILOT INVESTIGATION,
National Center for Atmospheric Research, Boulder, Colo.; Clark Univ., Worcester, Mass.; and Victoria Univ. (British Columbia).
Paul R. Julian, Robert W. Kates, and W. R. Derrick Sewell.
Water Resources Research, Vol 5, No 1, Feb 1969. p 215-227, 2 fig, 6 tab, 14 ref.

Descriptors: Projects, *Weather modification, Technology, Probability.
Identifiers: *Research and payoff model, *Evaluation of alternatives, Research success.

This paper has two objectives. First, it outlines a research and payoff (R and P) model that suggests a procedure for evaluating competing or concurrent research projects. Weather modification has been touted as an answer to many water resource problems. Alternatives have received little attention. Second, the paper makes a pilot study to determine the estimated probabilities of success of various technologies in the atmospheric sciences. A questionnaire was sent to professional atmospheric scientists to determine whether (a) scientists are willing to provide probability estimates of success of various technologies and whether these estimates are consistent with other estimates of success; (b) personal involvement in a field influences such estimates; (c) the probability estimates are consistent with the respondents' assignment of shares in a research budget; and (d) the estimates agree with reports of 'blue-ribbon' panels of experts. It is concluded that reasonably consistent estimates of research success are obtainable. The degree of optimism among those sampled is high; it is highest for those workers involved in and having a high degree of knowledge of a particular field. Continued efforts in the determination of research success probabilities are recommended. (Gossen-Chicago)
W69-08633

SNOW ACCUMULATION AND DISAPPEARANCE BY ASPECT AND VEGETATION TYPE IN THE SANTA FE BASIN, NEW MEXICO,
Forest Service (USDA), Albuquerque, N. Mex. Rocky Mountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 02C.
W69-08645

SOIL-MOISTURE TRENDS AFTER THINNING AND CLEARCUTTING IN A SECOND-GROWTH PONDEROSA PINE STAND IN THE BLACK HILLS,
Forest Service (USDA), Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 02G.
W69-08647

WATERSHEDS ASSUME IMPORTANT ROLE IN FOREST MANAGEMENT IN HAWAII,
Forest Service (USDA), Honolulu, Hawaii. Pacific Southwest Forest and Range Experiment Station.
For primary bibliographic entry see Field 04D.
W69-08650

IN HAWAIIAN WILDLANDS WATER BECOMES THE MOST IMPORTANT FOREST CROP,
Forest Service (USDA), Honolulu, Hawaii. Pacific Southwest Forest and Range Experiment Station.
For primary bibliographic entry see Field 04D.
W69-08651

RAINFALL INTERCEPTION BY ANNUAL GRASS AND CHAPARRAL...LOSSES COMPARED,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
For primary bibliographic entry see Field 02I.
W69-08662

SELECTIVE CONTROL OF BRUSH ON CHAPARRAL WATERSHEDS WITH SOIL-APPLIED FENURON AND PICLORAM,
Forest Service (USDA), Tempe, Ariz. Rocky Mountain Forest and Range Experiment Station.
Edwin A. Davis, and Charles P. Pase.
USDA Forest Serv Res Note RM-140, 1969. 4 p.

Descriptors: *Herbicides, *Chaparral, *Brush control, *Water yield improvement, Forest management, Watershed management, Pesticides, Agricultural chemicals, Chemicals, Urea pesticides, Wildlife management, Habitat improvement, Soil treatment, Brush.
Identifiers: *Fenuron, *Picloram.

Pelleted fenuron and picloram were applied by hand as spot treatments to increase water yield. Desirable browse species for big game can be retained by this method. Picloram, at half the application rate of fenuron, was less toxic than fenuron to the oaks, but more toxic to the other shrubs. Season of application, particularly as it relates to precipitation pattern is important in the performance of soil-applied herbicides in Arizona. Two natural products of chaparral watersheds are water and big game. To achieve a maximized balanced output of these products it is proposed that a nonselective brush eradication treatment be followed by grass and browse establishment programs. This approach would allow the establishment of specific browse shrubs in desired densities for a maximized balanced output of water and game. (Authors)
W69-08663

INCREASING WATER YIELD FROM FOREST, CHAPARRAL, AND DESERT SHRUB IN ARIZONA,
C. P. Pase, and Martin M. Fogel.
Int Conf on Water for Peace Proc, Vol 2, p 753-764, 1967. 12 p, 6 fig, 5 ref. For 8-volume proceedings see Vol 2, No 9, 06B, W69-03305.

Descriptors: *Arid lands, *Watershed management, Arizona, Demonstration watersheds, Runoff, Small watersheds, Caliche, Hand pan, Evaporation control, Evapotranspiration control, Soil-water plant relationships, Water yield improvement, Cutting management, Flow augmentation, Chaparral, Grasslands, Coniferous forests, Deserts.
Identifiers: *Vegetation manipulation, Sodium chloride.

Increasing human water needs in arid lands have stimulated research on vegetation and soil surface manipulation to decrease evapotranspiration and soil surface evaporation. Extent and composition of forest, chaparral and desert shrub in Arizona are outlined. A commercial timber harvest, 45% basal area, did not significantly increase water yield; but, conversion of moist-site mixed conifers to grass increased stream flow 8.4 cm/yr. Previously burned dense chaparral increased water yields 8 to 25 cm/yr after conversion to grassland. Supression of shrubs with annual (4) aerial application of 2,4,5-T permitted development of herbaceous cover. An increase of 1.2 cm of surface runoff was obtained in desert shrub vegetation areas with the application of sodium chloride to alter infiltration characteristics of the surface soil. Runoff water was of excellent quality for agricultural use. (Sherbrooke-Ariz)
W69-08685

3C. Use of Water of Impaired Quality

TOWARD FULL WATER UTILIZATION IN SAUDI ARABIA,
H. E. Hassan Mishari.
Int CONF on Water for Peace, Vol 2, p 832-841, 1967-68. 10 p, 2 fig. For 8-volume proceedings see Vol 2, No 9, 06B, W69-03305.

Descriptors: *Water resources development, *Water resources planning, *Groundwater, Deserts, Aquifer characteristics, Deep wells, Irrigation programs, Saline water, Desalination, Water utilization efficiency.
Identifiers: Saudi Arabia.

This is a review of water problems and governmental interest in water development in a desert kingdom. A general hydrogeological sketch includes discussion of 'fossil' water, geologic down-dip, and coastal brackish underground waters. Saudi experts and teams of experienced international experts and consultants are employed in the evaluation of the groundwater resources. The major methods of investigation are costly drilling and aquifer testing. AQUIFER COEFFICIENTS OF STORAGE AND TRANSMISSIBILITY WILL BE CALCULATED. Chemical composition, recharge, and isopiezometric surface of the different aquifers will be studied. Potentialities of subsurface dams and infiltration galleries are being investigated. A discussion is presented of water development projects in progress, which include land reclamation, irrigation, drilling, flood control, municipal and stock water supplies and desalination. Water costs are considered in relation to use. (Sherbrooke-Ariz)
W69-08687

PRACTICAL APPLICATION OF FOAM FRACTIONATION TREATMENT OF LOW QUALITY WATER,
Alaska Univ., College. Inst. of Water Resources.
R. Sage Murphy.
Completion Report to Office of Water Resources Research, Department of the Interior, Washington, DC, August 1969. 11 p. OWRR Proj No A-024-ALAS.

Descriptors: *Foam fractionation, *Flotation, *Deferrization.

A foaming technique, using ethylhexadecyldimethylammonium-bromide, bubble aeration, no reflux or recycle, and ground waters was tested for iron removal efficiencies. The intent of the project

was to utilize local materials and labor, as found in remote Alaskan areas, for the construction of the batch treatment process. Although previous laboratory studies indicated the process was satisfactory, field tests were unsatisfactory and further development is deemed unwarranted. Some function of water temperature is believed to have inhibited the reaction. Since close temperature control would be uneconomical for the purpose intended for the unit, the attempt to sophisticate the system was abandoned. The best results obtained in the prototype unit removed 61.9 percent of the iron, leaving a residual of 7.8 mg/l, 20 times the minimum USPHS standard. Most runs achieved, on the average, 11.15 percent iron removal, equivalent to a residual of 23.54 mg/l Fe++. (Author)
W69-08690

SOME ASPECTS OF WATER SUPPLY AND SEWERAGE IN ROMANIA (ROMANIAN),
State Water Committee, Bucharest (Rumania).
For primary bibliographic entry see Field 05D.
W69-08962

3F. Conservation in Agriculture

NUCLEAR ENERGY AND THE AGRO-INDUSTRIAL COMPLEX,
Oak Ridge National Lab., Tenn.
Alvin M. Weinberg.
Nature, Vol 222, No 5188, p 17-21, Apr 1969. 5 p, 3 fig, 2 tab, 4 ref.

Descriptors: *Nuclear energy, *Agriculture, Industries, Wheat, Crops, Nuclear engineering, Desalination, Demineralization, Water costs, *Crop production, Charts, Grains (Crops), *Electric power, Powerplants, *Agronomy, *Nuclear powerplants, Experimental farms, Professional personnel, Demonstration farms.
Identifiers: Breeder reactors, Israel, Great Britain, *Nuclear power, Tables (Data), Nuclear desalination devices.

Scientists at the Oak Ridge National Laboratory, Tenn, believe that a nuclear-powered agro-industrial complex could be an instrument for social and economic improvement in underdeveloped countries and a means for providing more food for the world's growing population. This complex would consist of an integrated collection of heavy chemical industries clustered around large reactors and desalting plants, and associated with a highly mechanized, scientific farm. The farm would essentially be a food factory. Initial studies are underway to locate such complexes in the Gujarat Peninsula in India and the southeastern rim of the Mediterranean. Israel has plans for 2 experimental farms in Negev where scientific agriculture, based on using distilled water for irrigation, is to be conducted. Tables and charts showing costs of distilled water, crop water-yield relationships, and cost details and sensitivity of agro-industrial complexes are given. (USBR)
W69-08840

COST OF PUMPING IRRIGATION WATER IN TEN NEW MEXICO COUNTIES,
New Mexico State Univ., University Park. Dept. of Agricultural Economics.
Roger B. Long.
Agricultural Experiment Station, New Mexico State University, Bulletin 490, March 1965. 43 p, 13 fig, 29 tab, 1 append, 4 ref.

Descriptors: *Pumping, *Irrigation, *Average costs, Water yield.
Identifiers: *New Mexico.

This study determined the average costs of pumping irrigation water. Also, the relation of these costs to pump yield was studied. Data were obtained through personal interviews with farmers. The average costs per acre-foot of water pumped in ten counties were reported. A description of the crops, physical irrigation characteristics, and costs of each county studied were included. In the conclusion pump costs are related to pump yields so that farmers can tell how their costs will change when they increase or decrease their pump yields. (Grossman-Rutgers)
W69-08963

04. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control of Water on the Surface

MAYNARD V HAWLEY (SUIT TO ENJOIN DRAINAGE OF WATER UPON LAND).

331 Mich 123, 49 NW2d 92-95 (1951).

Descriptors: *Michigan, *Surface drainage, *Road construction, *Surface runoff, Drainage engineering, Drainage, Ditches, Culverts, Channels, Surface water, Highways, Roads, Swamps, Rain water, Ponds, Flooding, Legal aspects, Judicial decisions.
Identifiers: Injunction.

A newly constructed highway separated plaintiff's land from the higher land of the defendant. Suit was brought to enjoin defendants' (private landowner and county road commission) drainage of water from higher property onto plaintiff's land. The court first noticed that the highway commissioners had the right to drain surface water, falling or naturally coming upon the highway, through natural and usual channels upon and over lower lands. Drains could be constructed for such purpose. The court held that the evidence sustained the finding that the ditches and culverts did not increase the amount of water flowing upon the land involved, but rather such land received substantially the same amount of surface water which it had received for years past. The court affirmed the findings for defendants. (Logan-Fla)
W69-08634

ALKALI SACATON SEEDLING SURVIVAL AND EARLY GROWTH UNDER TEMPERATURE AND MOISTURE STRESS,
Forest Service (USDA), Albuquerque, N. Mex. Rocky Mountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 02I.
W69-08643

EMERGENCY MEASURES TO CONTROL EROSION AFTER A FIRE ON THE SAN DIMAS EXPERIMENTAL FOREST,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
R. M. Rice, R. P. Crouse, and E. S. Corbett.
US Dept Agr Misc Publ 970, p 122-130, 1965.

Descriptors: *Erosion control, *Check structures, *Demonstration watersheds, *Contour furrows, *Grasses, Soil erosion, Burning, Overland flow, Slope stability, Terracing, Barley, Watershed management, Rain, Peak discharge.
Identifiers: *Contour trenches, *Stabilization, *Annual grasses, San Dimas Experimental Forest.

After the 1960 fire, 20 experimental watersheds were given various erosion control treatments. From measurements made during four moderate sized storms in the 1962 hydrologic year it was concluded that side slope stabilization by contour furrow planting with barley was the most effective treatment. Because of its low cost, broadcast sowing of annual grass was also recommended. Contour trenches were found to be unsatisfactory because terrain and storm size made underdesign inevitable. Seeding of perennial grass was followed-up with herbicide to affect a conversion. This treatment resulted in very little vegetation and accelerated runoff and erosion. (Authors)
W69-08652

EMERGENCY REVEGETATION TO REHABILITATE BURNED WATERSHEDS IN SOUTHERN CALIFORNIA,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
E. S. Corbett, and L. R. Green.
US Forest Service Research Paper PSW-22, 1965. 14 p.

Descriptors: *Revegetation, *Demonstration watersheds, *Competition, *Watershed management, Burning, Grasses, Chaparral, Vegetation regrowth, Erosion control, Barley, Plant management, Herbicides, Brush control.
Identifiers: *Experimental watersheds, *Burned watershed, *Plant competition, *Annual grass, Broadcast seeding.

Reports 4-year results of revegetation measures tested for emergency erosion control after fire denuded the San Dimas Experimental Forest in 1960, including establishment of seeded grasses and their influence on recovery of native vegetation. (Authors)
W69-08654

SOIL SLIPPAGE INCREASED BY BRUSH CONVERSION,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
Edward S. Corbett, and Raymond M. Rice.
US Forest Service Res Note PSW-128, 1966. 8 p.

Descriptors: *Grasses, *Debris avalanches, *Creep, *Brush control, Chaparral, Soil erosion, Mass wasting, Landslides, Rain, Burning, Slope stability, Soil mechanics.
Identifiers: Mass soil movement, *Soil slips, *Brush conversion, Soil depth.

After a fire burned the San Dimas Experimental Forest, near Glendora, Calif., in 1960, about 350 acres of brushland were converted to grass. Six years later, the frequency and extent of soil slips -- a form of gravitational mass movement -- on this acreage was compared with those on comparable sites where brush cover was recovering naturally after the fire. Both the area affected and the number of soil slips were about five times greater on the grass-covered areas than on the brush areas. (Authors)
W69-08655

WATER REPELLENT SOILS AND THEIR RELATION TO WILDFIRE TEMPERATURES,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
For primary bibliographic entry see Field 02G.
W69-08657

FORMATION OF NON-WETTABLE SOILS...INVOLVES HEAT TRANSFER MECHANISM,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
For primary bibliographic entry see Field 02G.
W69-08658

SOIL WETTABILITY AND WETTING AGENTS...OUR CURRENT KNOWLEDGE OF THE PROBLEM,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
For primary bibliographic entry see Field 02G.
W69-08659

SEED GERMINATION AND ESTABLISHMENT AS AFFECTED BY NON-WETTABLE SOILS AND WETTING AGENTS,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station; and California Univ., Riverside.
For primary bibliographic entry see Field 02G.
W69-08660

SEASONAL DEBRIS MOVEMENT FROM STEEP MOUNTAIN SLIDE SLOPES IN SOUTHERN CALIFORNIA,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
Jay S. Krammes.
USDA Misc Pub 979, 1965, p 85-89.

Descriptors: *Erosion, *Watershed management, *Accelerated erosion, *Scour, *Sediment yield, Sheet erosion, Alluvium, Creep, Geomorphology, Sedimentation, Forest fires, Mountain forests.
Identifiers: Southern California, Chaparral watersheds, *Debris movement.

Summarizes debris measurements during a 9-year period at nine sites in the San Gabriel Mountains. The accelerated eroision after the fire accentuated the difference in erosion rates observed before the fire. The south rejuvenated slopes showed a tenfold increase in debris production, 90 percent of which occurred during the dry season. (Author)
W69-08664

IN RE SCIOTO-SANDUSKY CONSERVANCY DISTRICT (FLOOD CONTROL DISTRICTS).
For primary bibliographic entry see Field 06E.
W69-08777

WATERSHEDS.
For primary bibliographic entry see Field 06E.
W69-08785

ESTABLISHMENT OF WATERSHED DISTRICTS.
For primary bibliographic entry see Field 06E.
W69-08786

FUNCTIONS AND AUTHORITY OF WATERSHED DISTRICT MANAGERS.
For primary bibliographic entry see Field 06E.
W69-08787

WATERSHEDS AND DRAINAGE SYSTEMS.
For primary bibliographic entry see Field 06E.
W69-08788

PROVISIONS RELATING TO FLOOD CONTROL COMPACT.
For primary bibliographic entry see Field 06E.
W69-08793

DAMS AND DRAINS; GENERAL PROVISIONS.
For primary bibliographic entry see Field 06E.
W69-08794

TAX DITCHES.
For primary bibliographic entry see Field 06E.
W69-08798

OBSTRUCTIONS AND DAMAGE TO ROADS.
For primary bibliographic entry see Field 06E.
W69-08799

GASSAWAY V TRAVELERS INS CO (DAMAGE FROM UNDISCLOSED STORM SEWER).
For primary bibliographic entry see Field 06E.
W69-08809

DRAINAGE AND FLOOD CONTROL.
For primary bibliographic entry see Field 06E.
W69-08825

TRANSIENT CONTROL IN THE LOWER SACRAMENTO RIVER,
California State Dept. of Water Resources, Sacramento.
Fred J. Gientke.
Pap, Tech Memo No 39, Dep Water Resour, State Calif, Sept 1968. 36 p, 13 fig, 11 ref, 2 append.

Descriptors: *Hydraulic transients, *Weirs, Transients, Forecasting, Unsteady flow, *Gate control, *Gates, Automatic control, Control, Flow profiles, *Flood control, Hydraulics.
Identifiers: Sacramento River (Calif), American River (Calif), Transient flow.

During periods of high water on the Sacramento River, the City of Sacramento is protected by opening the gates of the Sacramento Weir, located several miles above the city. The transient-controlling gate and valve stroking concept was used in developing the plan of operation. Basic unsteady-state equations used in calculating river profiles during flood periods are given. A method for selecting a compatible dx and dt is discussed. System boundary conditions and methods for solving for system inflow and outflow are presented. The treatment assumes the availability of initial steady-state conditions in the conveyance system, providing background material that will be used for developing the technique for controlling transients in the Sacramento River. In addition to the Sacramento Weir, such a capability can be extended to the operation of the San Joaquin River, the lower San Joaquin River flood control project, and is being considered for operating various reaches of the California State Water Project. (USBR)
W69-08844

4B. Groundwater Management

THE RESEARCH OF FRESH WATER IN A SALINE ENVIRONMENT,
P. Lenk.
Int CONF on Water for Peace, Vol 2, p 862-868, 1968. 7 p, 3 fig, 1 ref. For 8-volume proceedings see Vol 2, No 9, 06B, W69-03305.

Descriptors: *Arid lands, *Alluvial channels, *Artificial recharge, Aquifer characteristics, Deltas, Groundwater recharge, Recharge wells, Underground streams, Coastal plains, Freshwater-saline water interfaces.

This paper describes procedures for coastal plains and river delta freshwater search, and presents a method of recharge in arid zones. An example of water search in the horizontal aquifers near Karachi, Pakistan is outlined. A 'linear' survey was substituted for an 'areal' survey and a 'channel' of low velocity, decreasing downstream was discovered. Other examples of 'channels' of freshwater passing through underground salt water are presented from Dahomey and Eastern Pakistan. The causes of these 'channels' are not fully understood, but may depend on their low velocities. Slumping of alluvial formations in large deltas increases their gradient and their water collecting ability. Data show that no single sheet of water is present, but rather a multitude of 'channels', the independence of which disappears downstream as deposits of silt stop water movement. Water search is best accomplished by transverse lines of boreholes across the delta. Details of a recharging method are presented. (Sherbrooke-Ariz)
W69-08686

TOWARD FULL WATER UTILIZATION IN SAUDI ARABIA,
For primary bibliographic entry see Field 03C.
W69-08687

INCREASING THE INTENSITY OF DRAINAGE OF THE GROUND BY VACUUMING,
Ministry of Melioration and Water Resources Management (USSR).
I. V. Minayev, T. P. Gorezko, A. A. Vasil'yevskiy, and R. F. Lukoshko.
Soviet Hydrol: Selec Pap, Issue No 2, p 171-178, 1968. 8 p, 4 fig, 3 tab, 4 ref.

Descriptors: *Drainage, *Drainage systems, *Tile drainage, *Vacuum drying, Pumping, Aeration, Subsurface drainage, Drainage engineering, Model studies, Hydraulic models, Land management.
Identifiers: Vacuum soil drainage systems.

The application of artificial vacuum to tile drain systems to enhance water table lowering and to increase soil aeration was evaluated by laboratory tank and flume studies. Moisture content of wet soils can be reduced by increasing drain depth, reducing drain spacing, and by applying vacuum. The use of vacuum pumps can be less expensive than deepening drains or changing their spacing. (Knaap-USGS)
W69-08731

NEW THRUSTS IN GROUND WATER,
Geological Survey, Washington, D. C.
C. L. McGuinness.
Ground Water, Vol 7, No 2, p 7-10, Mar-Apr 1969. 4 p, 2 ref.

Descriptors: *Groundwater, *Aquifers, Forecasting, Water supply, Waste disposal, *Underground water storage, Fresh water, Groundwater recharge, Demineralization, Desalination, Water management (Applied), Systems analysis, Injection wells.
Identifiers: Saline ground water, Groundwater hydrology.

Four principal trends in ground water are apparent: (1) Increasing use will be made of ground water for domestic supplies. Geohydrologists must learn to evaluate quantitatively the water supply under conditions of maximum development. (2) Aquifers will be evaluated as possible storage media for surplus flood water, in place of dams and reservoirs. The key here is economics--optimum use of resources. (3) Saline aquifers will be viewed as sources of water supply. The cost curves of developing new supplies of fresh water are ascending while the cost curves for desalinization are declining, and inevitably they will cross. (4) With efforts to prevent stream pollution, aquifers will be considered as possible storage media for industrial and domestic waste effluents. Control is needed so that the effects of waste injection can be predicted, the technology for confining those effects as intended can be developed, and a basis can be provided for a rational decision as to whether waste injection or an alternative use of the chosen aquifer is best for the economy. A systems-analysis approach is needed to develop a working model of a given hydrologic and socio-economic problem from which quantitative answers can be given to water planners. (USBR)
W69-08864

NEED FOR SALINE GROUNDWATER DATA TO ADVANCE DESALTING TECHNOLOGY,
Office of Saline Water, Washington, D. C.
For primary bibliographic entry see Field 03A.
W69-08867

4C. Effects on Water of Man's Non-Water Activities

URBAN WATER RESOURCES RESEARCH,
American Society of Civil Engineers, New York. Urban Hydrology Research Council.
M. B. McPherson.
Amer Soc Civil Eng Annu Prog Rep, 1968. 43 p, 4 fig, 3 tab, 38 ref, 11 append. L. S. Tucker, Director.
Work supported by OWRR, Dept of Interior. OWRR Contract No 14-01-0001-1585.

Descriptors: *Urbanization, *Rainfall-runoff relationships, *Systems analysis, *Surveys, Data collections, Hydrologic data, Model studies, Research and development.
Identifiers: *Urban hydrology, Urban water resources.

Activities in urban water resources research by ASCE in 1967-1968 are reported. The objective of the research is to provide guidelines for ititiating and expanding a program of long-range studies in urban water problems. Considerable attention was given to storm drainage to arrive at mathematical descriptions of the rainfall-runoff relationship, to predict pollution loads, and to develop methods of planning water quantity, quality, and drainage development. Data collection system design and data requirements are discussed. Systems analysis, statistical studies, and model studies are being initiated. Considerable attention was given to research needs in political, economic, social, legal, and related aspects of urban hydrology. Appendices contain technical and feasibility studies of modeling, flood damages, non-hydrological aspects, research needs, systems engineering, and economics. (Knapp-USGS)
W69-08743

THE FINGER PLAN - A CONCEPT OF ORDER.
Northeastern Illinois Planning Commission, Chicago, Ill.
For primary bibliographic entry see Field 06B.
W69-08877

STATISTICAL APPENDIX,
Nevada Univ., Reno. Div. of Agricultural Economics and Education; and Nevada Univ., Reno. Max C. Fleischmann Coll. of Agriculture.
George A. Myles.
Max C. Fleischman College of Agr, Univ of Nevada, Pub No B18, Feb 1968. 80 p, 40 tab, 2 exhibits.

Descriptors: *Recreation demand, *Data collections.

This publication is the statistical appendix to the series of publications concerning the demand for water based recreation in Nevada. This publication contains statistical material on which previous material was based. (Grossman-Rutgers)
W69-08964

ECONOMIC IMPACT OF RECREATIONAL DEVELOPMENTS IN THE RESERVE RANGER DISTRICT,
New Mexico State Univ., University Park. Dept. of Agricultural Economics.
James R. Gray, and Garrey E. Carruthers.
Agricultural Experiment Station, New Mexico State University, Bulletin 515, Nov 1966. 25 p, 1 fig, 14 tab, 1 append, 5 ref.

Descriptors: *Input-output analysis, *Economic impact, *Recreation, Sampling, Multi-purpose reservoirs.
Identifiers: *Reserve Ranger District of New Mexico.

This study determined how local industries in west-central New Mexico would be affected by an increase in recreational activities. A multi-purpose reservoir was proposed. Input-output analysis was used to determine how this project would affect the local industries. Included in the study are physical and economic descriptions of the reserve area. The results include a flow table of industry flows of goods and services, a table of technical coefficients which shows the monetary value produced or used in each sector per dollar of production, the economic impact of increased recreational activity, and the impact of increased activity on water and land requirements of local industries. A conclusion is given. The appendix illustrates the development of the descriptive model used in the input-output analysis. (Grossman-Rutgers)
W69-08967

ECONOMIC DEVELOPMENT THROUGH PLEASURE AND PROFIT,
Oklahoma State Univ., Stillwater. Dept. of Agricultural Economics.
Dan Badger, and Dean Barrett.
First Annual Oklahoma Outdoor Recreation Conference Proceedings, March 9 and 10, 1967. 121 p.

Descriptors: *Recreation, *Recreation demand, Consumptive use.
Identifiers: *Oklahoma.

The conference included those interested in outdoor recreation from both the public and private sectors of Oklahoma. The orientation of the discussions was the potentials for the problems of outdoor recreation. Some of the topics covered were: demand for recreation in Oklahoma, consumer preferences, development of state recreation facilities, water based hunting, and loans available for recreation. (Grossman-Rutgers)
W69-08971

4D. Watershed Protection

SNOW ACCUMULATION AND DISAPPEARANCE BY ASPECT AND VEGETATION TYPE IN THE SANTA FE BASIN, NEW MEXICO,
Forest Service (USDA), Albuquerque, N. Mex. Rocky Mountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 02C.
W69-08645

SOIL TEMPERATURES UNDER FOREST AND GRASSLAND COVER TYPES IN NORTHERN NEW MEXICO,
Forest Service (USDA), Albuquerque, N. Mex. Rocky Mountain Forest and Range Experiment Station.
Howard L. Gary.
US Forest Serv Res Note RM-118, 1968. 11 p, illus.

Descriptors: *Temperature, *Vegetation effects, *Snow cover, *Snow management, *Watershed management, Soil environment, Cold regions, Frozen soils, Temperature control, Mountain forests, Coniferous forest, Weather data, Soil temperature, New Mexico.

Temperatures for selected soil depths (1.5 to 112 inches) under aspen, Douglas-fir, spruce-fir and grassland types on north- and south-facing aspects from 9,900 to 11,150 feet above m.s.l. are reported for 1 year. Plant cover type was more important in modifying soil temperature than aspect, elevation, or snow cover. Average annual temperature for the first 12 inches of soil ranged from 33.2 deg F on the north-aspect spruce-fir at 11,150 feet to 40.8 deg F on the south-aspect aspen at 9,900 feet. Depth of freezing temperatures during the period of snow cover ranged from 1.5 to 3 feet. (Author)
W69-08646

WATERSHEDS ASSUME IMPORTANT ROLE IN FOREST MANAGEMENT IN HAWAII,
Forest Service (USDA), Honolulu, Hawaii. Pacific Southwest Forest and Range Experiment Station.
Robert E. Nelson.
Western Conservation Journal, Vol 21, No 6, p 56-57, 1965. 6 fig.

Descriptors: *Watershed management, *Hawaii, Forestry, Forest management, *Vegetation effects, Erosion control, Reforestation.
Identifiers: *Multiple use, *Forestry research.

While water is the most important resource of Hawaii's forest lands, other products and uses can be compatible with good watershed management. A forestry research program is underway to develop knowledge to support multiple-use management. (Merriam-Forest Serv)
W69-08650

IN HAWAIIAN WILDLANDS WATER BECOMES THE MOST IMPORTANT FOREST CROP,
Forest Service (USDA), Honolulu, Hawaii. Pacific Southwest Forest and Range Experiment Station.
Paul D. Duffy.
Western Conservation Journal, Vol 21, No 6, p 58-59, 1965. 2 fig.

Descriptors: *Land use, *Hawaii, Watershed management, Reforestation, *Vegetation effects, Erosion control, Condensation, Forest management.
Identifiers: Fog drip, Multiple use.

Watersheds have been protected for their water supply by the Hawaii Division of Forestry for nearly 75 years. The U.S. Forest Service believes it is possible for Hawaii to have its water and realize other values from forest lands too. (Merriam-Forest Serv)
W69-08651

05. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification of Pollutants

WHEN DO STREAM TEMPERATURES BECOME A PROBLEM,
Philadelphia Electric Co., Pa. Dept. of Engineering and Research; and Cornell Univ., Ithaca, N.Y. Div. of Biological Sciences.
For primary bibliographic entry see Field 05B.
W69-08708

STRUCTURE OF THE WATER BALANCE OF BODIES OF WATER,
Ministry of Melioration and Water Resources Management (USSR).
For primary bibliographic entry see Field 02D.
W69-08729

DESCRIPTION OF THE DRAINAGE OF STREET FLUSHING WATERS,
Ministry of Melioration and Water Resources Management (USSR).
N. A. Pravoshinskiy.
Soviet Hydrol: Selec Pap, Issue No 2, p 168-170, 1968. 3 p, 2 tab, 9 ref.

Descriptors: *Water pollution sources, *Roads, *Urbanization, *Drainage systems, Storm drains, Municipal wastes, Oily water, Organic wastes, Sediments.
Identifiers: *USSR, Street cleaning wastes, Minsk, Moscow, Leningrad.

The quality and quantity of runoff from street washing operations in Minsk were measured to study the contribution of street washing to water pollution. Data from earlier studies in Moscow and Leningrad are included for comparison. The BOD of street cleaning runoff is 6-223 mg/liter, petroleum products are up to 110 mg/liter, and coliforms are nearly as abundant as in wastewater. These waters, unless they are treated, can be a major source of pollution. (Knapp-USGS)
W69-08732

OCCURRENCE AND DISTRIBUTION OF PHENOLIC COMPOUNDS IN NEW JERSEY'S STREAMS,
Samuel D. Faust, Peter W. Anderson, and Hansjakob Stutz.
1969 ASME/AIChE Stream Pollution Abatement Conference - June 12, 1969, Paper 69-PID-9 - Rutgers University. 8 p, 4 fig, 3 tab, 9 ref.

Descriptors: *Phenols, *Organic compounds, *Water pollution effects, *Analytical techniques, Industrial wastes, Water pollution, Water pollution

sources, Water quality, Chemical analysis, Chemical properties, Chemical reactions, Data collections.
Identifiers: *Taste and odor, Chlorophenols, Halogenated phenols, Palatable water.

Surface waters are receiving and transporting larger and larger volumes of domestic and industrial waste waters that may contain phenolic compounds. One of the more serious aspects of this water-quality problem is the lack of specific and sensitive analytical techniques for the detection of these compounds. In order to test the applicability of an improved 4-aminoantipyrine colorimetric procedure to natural waters, a program was undertaken to sample systematically 24 sites in six river systems and four ground-water sites in New Jersey and to examine these samples for phenol. This reconnaissance survey reveals concentrations in excess of 1.0 ug/l which is the 'recommended potable water-quality standard' established by the New Jersey State Department of Health. (Faust-Rutgers)
W69-08972

AN IMPROVED METHOD FOR EXTRACTION OF ORGANOCHLORINE AND ORGANOPHOSPHATE INSECTICIDES FROM LAKE WATERS,
Wisconsin Univ., Madison.
For primary bibliographic entry see Field 02H.
W69-09016

THE MOVEMENT AND STORAGE OF WATER IN NORTH CAROLINA SOILS AND THE ROLE OF THE SOIL IN DETERMINING WATER QUALITY,
North Carolina Univ., Chapel Hill. Water Resources Research Inst.
For primary bibliographic entry see Field 02G.
W69-09028

5B. Sources of Pollution

LOW HERBICIDE CONCENTRATION FOUND IN STREAMFLOW AFTER A GRASS COVER IS KILLED,
Forest Service (USDA), Franklin, N.C. Southeastern Forest Experiment Station.
J. E. Douglass, D. R. Cochrane, G. W. Bailey, J. I. Teasley, and D. W. Hill.
US Forest Serv Southeast. Forest Expt Station Paper No SE-108, 1969. 4 p.

Descriptors: *Herbicides, *Water quality, *2-4-D, *Paraquat, Water pollution, Watershed management, North Carolina, Agricultural chemicals, Pesticides, Pesticide residues.
Identifiers: *Atrazine, *Experimental watersheds, *Coweeta hydrologic laboratory.

The grass cover on a steep Appalachian watershed was sprayed in 1966 with herbicides--first with atrazine and paraquat and later with atrazine and 2,4-D. Although grass growing in the stream channel was sprayed during the first treatment, atrazine and paraquat levels in water samples were low. For the second treatment, a 10-foot strip on either side of the channel was left unsprayed. No increase in atrazine concentration was noted, and no 2,4-D was detected. Thus, use of these chemicals does not appear to constitute a water pollution hazard when reasonable care is taken to protect streamside vegetation and the stream from direct contamination. (Author)
W69-08642

PESTICIDES AND POLLUTION,
Bureau of National Affairs, Inc., Washington, D.C.
For primary bibliographic entry see Field 05C.
W69-08707

WHEN DO STREAM TEMPERATURES BECOME A PROBLEM,
Philadelphia Electric Co., Pa. Dept. of Engineering and Research; and Cornell Univ., Ithaca, N.Y. Div. of Biological Sciences.
Stanley Moyer, and Edward C. Raney.
Preprint No 834, Amer Soc Civil Eng Annu and Nat Meeting on Water Resources Eng, Feb 3-7, 1969, New Orleans, La, 1969. 42 p, 13 fig, 11 tab.

Descriptors: *Heated water, *Thermal powerplants, *Water temperature, *Biology, *Rivers, Reservoirs, Pennsylvania, Maryland, Water pollution sources, Waste water disposal, Water pollution control.
Identifiers: *Susquehanna River, Thermal discharges.

The effects of present and proposed thermal discharges on water temperatures in the Susquehanna River basin are discussed and the results of high water temperatures on aquatic life are surveyed. A model was constructed of the Conowingo Reservoir to study thermal discharges, water withdrawals, and the thermal budget. Isotherm plots show that under the most adverse conditions of record, the proposed cooling tower installation at the Peach Bottom powerplant can produce a satisfactory effluent temperature. No thermal barriers to fish migration are present. No reduction in species diversity is foreseen. No reduction in dissolved oxygen is expected. (Knapp-USGS)
W69-08708

DESCRIPTION OF THE DRAINAGE OF STREET FLUSHING WATERS,
Ministry of Melioration and Water Resources Management (USSR).
For primary bibliographic entry see Field 05A.
W69-08732

OIL POLLUTION: PROBLEMS AND POLICIES,

Bur Nat Aff Environ Manage Ser Rep, 1969. 142 p, 1 fig, 2 tab, 94 ref. Degler, Stanley E., Editor.

Descriptors: *Oily water, *Water pollution sources, *Ships, *Water pollution control, Legislation, Cleaning, Regulation, Water pollution treatment, International law, Water law.
Identifiers: Shipwrecks, Oil spills, Oil pollution acts.

Oil pollution caused by spillage from ships, shipwrecks, and other sources is discussed. Oil spillage control, cleanup, existing oil pollution legislation, and proposed laws are reviewed. The present state of oil spillage prevention, control, and restoration technology is outlined. The National Multi-Agency 0.1 and Hazardous Materials Pollution Contingency Plan is excerpted. Texts of the oil pollution acts of 1924 and 1961 are included. (Knapp-USGS)
W69-08752

DISPOSAL OF WASTEWATER FROM WATER FILTRATION PLANTS.
For primary bibliographic entry see Field 06E.
W69-08816

SUSQUEHANNA RIVER BASIN COMPACT - WATER SUPPLY AND WATER QUALITY MANAGEMENT AND CONTROL.
For primary bibliographic entry see Field 06E.
W69-08845

RESEARCH ON GROUND-WATER CONTAMINATED BY DEPOSITS OF SOLID WASTE,
Hessiches Landesamt fuer Bodenforschung, Wiesbaden (West Germany).
Arthur Golwer, and Georg Matthess.
Symp on Geoche, Precipitation, Evaporation, Soil-Moisture, Hydrom, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 78, p 129-133, 1968. 5 p, 4 ref.

Descriptors: *Waste disposal, *Waste dumps, *Leaching, *Path of pollutants, Biodegradation, Degradation (Decomposition), Sorption, Reduction (Chemical), Oxidation, Municipal wastes, Industrial wastes.
Identifiers: Surficial solid waste disposal.

The effects of solid waste disposal practices on groundwater quality was studied at large municipal and industrial disposal sites. Leaching causes a rise of dissolved organic and inorganic material in groundwater. The organic components are rapidly degraded by soil microorganisms. Anaerobic conditions caused by degradation of organic wastes cause reduction of dissolved inorganic wastes in a zone of only a few meters width immediately downstream from the disposal site. In this zone, dissolved iron concentrations as high as 21 ppm have been measured. Most inorganic contaminants are sorbed within a short distance of their sources, limiting the zone of groundwater contamination to definite boundaries. (Knapp-USGS)
W69-08918

THE EFFECTS OF TEMPERATURE AND DENSITY GRADIENTS UPON THE MOVEMENT OF CONTAMINANTS IN SATURATED AQUIFERS,
Alabama Univ., University. Dept. of Engineering Mechanics.
For primary bibliographic entry see Field 02F.
W69-08921

THE EFFECT OF CATION-EXCHANGE CAPACITY ON THE RETENTION OF DIQUAT AND PARAQUAT BY THREE-LAYER TYPE CLAY MINERALS: 2. PLANT AVAILABILITY OF PARAQUAT,
North Carolina Agricultural Experiment Station, Raleigh.
J. B. Weber, R. C. Meek, and S. B. Weed.
Soil Sci Soc Amer Proc, Vol 33, No 3, p 382-385, May-June 1969. 4 p, 3 fig, 13 ref.

Descriptors: *Adsorption, *Herbicides, *Clay minerals, *Phytotoxicity, Soil chemical properties, Organic compounds, Montmorillonite, Kaolinite, Ion exchange, Dequat, Paraquat.
Identifiers: Vermiculite.

Paraquat was adsorbed on varying amounts of Ca-montmorillonite and Ca-vermiculite. The herbicide-treated clays were added to a synthetic soil medium and cucumber seedlings were planted. Ca-montmorillonite effectively reduced the activity of approximately 90 to 95% of the adsorbed paraquat leaving only 5 to 10% available to the plants. Approximately 10% was also found to be exchangeable using .005 N solutions and is believed to be that which is adsorbed on external surfaces. The results are analogous to those found with other montmorillonites and suggest that the major portion of dipyridinium herbicides that are adsorbed on this clay mineral is probably adsorbed in a biologically unavailable form. Ca-vermiculite reduced the phytotoxicity of paraquat, but did not remove the phytotoxic effects completely. Substantial amounts of paraquat were also released from this clay mineral using salt solutions. The results are analogous to previous findings with kaolinite clay and suggest that the adsorption of this herbicide by soils in which vermiculite and kaolinite are the dominant clay minerals is probably largely in a biologically available form. (Knapp-USGS)
W69-08957

DETERMINATION OF ORGANOCHLORINE INSECTICIDES IN SOILS AND WATERS,
Wisconsin Univ., Madison.
H. B. Pionke, and G. Chesters.
Soil Science Society of America Proceedings, Vol. 32, No. 6, November-December 1968, 11 p, 82 ref, p 749-759. OWRR Proj B-016-Wis.

Descriptors: *Degradation, *Gas-chromatography, Insecticides.
Identifiers: *Organochloride insecticides, Volatization, Insecticide extraction.

Pertinent references on the determination of organochloride insecticides in soil and water samples are reviewed. The particular methods are chosen because of their applicability to heterogeneous systems which often provide problems due to coextraction of indigenous components. The review is divided into three principal sections, i.e., extraction of organochlorine insecticides from soils and waters, cleanup of soil and water extracts, and analysis of purified soil and water extracts. Criteria used in evaluating extraction procedures were based on methods of equilibrating the insecticide with the soil sample and the control of possible insecticide losses through degradation and volatization. In the section on cleanup procedures special attention is devoted to chromatographic methods, particularly column and thin-layer chromatography. A large portion of the methods of final analysis of purified extracts is given over to gas-liquid chromatographic techniques because of the preponderance of its use for insecticide determination. The gas-liquid chromatographic methods are discussed on the basis of peak resolution, detection and measurement of the insecticides, and confirmation of their identity. Thin-layer chromatographic, spectrophotometric, and other methods of determination of organochlorine insecticides in purified extracts are evaluated. (Pionke-Wis)
W69-09018

MEASUREMENT OF BIOLOGICAL N2 FIXATION,
Wisconsin Univ., Madison.
For primary bibliographic entry see Field 02H.
W69-09021

5C. Effects of Pollution

CHARACTERISTICS AND SIGNIFICANCE OF RESISTANCE TO INSECTICIDES IN FISHES,
Mississippi State Univ., State College. Dept. of Zoology.
Denzel E. Ferguson.
Southern Div Amer Fish Soc, Reservoir Fishery Resources Symposium, p 531-536, 1967. 12 ref.

Descriptors: *DDT, *Aldrin, *Dieldrin, *Endrin, Pesticides, Fish, Shiners.
Identifiers: *Pesticide resistance, Bluegill, Gambusia, Green sunfish.

Several species of freshwater fishes of the Mississippi Delta region exhibit resistance to a variety of pesticides. Populations of bluegill, green sunfish and golden shiners were found to be resistant to endrin, aldrin, dieldrin and toxaphene, but susceptible to DDT. Pesticide-resistant populations apparently develop as a result of intraspecific variations in tolerance; bioassays of fish from pesticide-free areas reveal rare individuals with high tolerances, suggesting preadaptive genetic mechanisms. Levels of resistance are apparently related to the chemical stability of the pesticide. Resistant populations may accumulate sufficient levels of pesticides to constitute a hazard to susceptible populations of organisms, including man. Several examples of pesticide-resistant fish and their effects on susceptible fish are cited. (Voightlander-Wis)
W69-08667

CHEMICAL FERTILIZERS ON LAKE WATERS (IN GERMAN),
Von Heinz Ambuhl.
Summaries in English and French. Gas- und Wasserfach, Vol 107, No 14, p 357-363, Apr 1966. 6 fig, 2 tab, 18 ref.

Descriptors: *Eutrophication, *Nutrients, *Lakes, Ponds, Fertilizers, Algae, Nitrogen, Phosphorus, Water pollution effects, Water pollution sources, Water pollution control, Oxygen balance, Sewage, Runoff.
Identifiers: Lake Lucerne, Fertilized fields, Subterranean drainage, Mechanical and biological purification, Switzerland.

The pollution of lakes and ponds is in a large part due to inorganic salts promoting algal growth and subsequent processes of decomposition. As revealed by studies of Lake Lucerne, a few parts per million of fertilizer salts, particularly phosphates, are sufficient to stimulate the growth of algae and upset the oxygen balance. A large fraction of eutrophying substances is brought to lakes from fertilized fields via run-off and subterranean drainage. The amount of phosphorus from these sources is equal to that supplied by the normal discharges of sewage; the amount of nitrogen delivered from fields exceeds that contributed by sewage. On the average, Swiss lakes receive 0.3 to 0.5 kg of phosphorus and about 45 kg of nitrogen per hectare, per year; the latter figure is derived from a very wide amplitude. This inflow of nutrients is sufficient to eutrophy lakes, but the only corrective measure available at this time is purification of the sewage by mechanical and biological methods eliminating plant nutrients. (Wilde-Wis)
W69-08668

EFFECTS OF TEMPERATURE AND BODY WEIGHT ON ENDOGENOUS NITROGEN EXCRETION IN THE BLUEGILL SUNFISH (LEPOMIS MACROCHIRUS),
Indiana Univ., Bloomington. Dept. of Zoology.
Jan Savitz.
J Fish Res Board Canada, No 26, p 1813-1821, 1969. 2 fig, 4 tab, 17 ref.

Descriptors: *Metabolism, *Nitrogen, *Temperature, Proteins, Sunfishes.
Identifiers: *Lepomis macrochirus, *Nitrogen excretion, Protein maintenance.

The protein maintenance level for a population of bluegill sunfish was estimated on a seasonal and yearly basis. Effects of temperature (range: 7.2 to 32.2 deg C) and body weight on endogenous nitrogen excretion (ENE) were determined by feeding a non-protein diet (glucose). Values of weight exponents in weight-metabolic rate relationship (log Y= log a+ b log W) were nearly identical for all temperatures. Mean rates of nitrogen excretion for two size groups of fish (10 and 100 grams) increased with rising temperature, with rates at 29 to 32 deg C being exceptionally high and significantly different from rates obtained at lower temperatures. No resistance adaptation was noted at high temperatures. Protein maintenance levels were estimated at 15.29 kilograms protein for summer (June-August) and 2.43 kilograms for any 30-day period from September through May, based on population of 6260 fish. The total (annual) maintenance level was estimated at 37.54 kilograms. Graphical data include body weight-metabolic rate relationships and maintenance nitrogen levels. Tabular data include nitrogen excretion rates at different temperatures and ENE rates by age group. (Voightlander-Wis)
W69-08670

EUTROPHICATION OF INLAND WATERS.
Water Pollution Research Lab., Stevenage (England).

Ministry of Technology Notes on Water Pollution, No 41, 4 p, June 1968. 1 fig, 2 tab, 12 ref.

Descriptors: *Eutrophication, *Nutrients, *Lakes, Oligotrophy, Sewage effluents, Nitrogen, Phosphorus, Detergents, Fertilizers.
Identifiers: *Assessment of eutrophication, *Utilization of nutrients, *Sources of nutrients, *Control of eutrophication, Inland waters, Algal nuisance, Algal blooms, Agricultural runoff, Nutrient removal, Lake Zurich, Lake Washington (Wash), River Lee, River Thames, Great Ouse, England, Switzerland.

Eutrophication is the natural aging of lakes, often hastened by man's activities, which may give rise to such problems as taste and odor in water supplies, filter clogging, disappearance of game fish, and interference with recreation. To quantitatively define the degree of eutrophication many methods may be used: measurement of dissolved oxygen, rates of oxygen depletion, biological productivity, transparency, nutrient level, and chlorophyll 'a' content of surface waters. Newly developed is a form of bioassay involving culture techniques with single algal species for measuring the growth-promoting properties of various waters and effluents. Factors necessary for algal growth have been studied, with nitrogen and phosphorus believed to be the major nutrients controlling algal growth; they are also the most prominent nutrients in sewage effluents and fertilizers. The greatest single source of nitrogen and phosphorus in surface water is agricultural runoff; however, much phosphate enters from domestic sewage greatly enriched in recent years by detergents. To control eutrophication nutrient-rich waters can be diverted, as in Lake Washington, or nutrients removed from effluents. Phosphorus can be reduced using lime, ferric, or aluminum hydroxides; nitrate by microbial denitrification; and ammonia by air-stripping--all at considerable cost and with limited success in eliminating the problem. (Ketelle-Wis)
W69-08672

UPTAKE AND LOSS OF RADIONUCLIDES BY THE FRESHWATER CLAM LAMPSILIS RADIATA (Gmel),
Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.
R. S. Harvey.
Health Physics, Vol 17, p 149-154, Pergamon Press 1969. 4 fig, 3 tab, 8 ref.

Descriptors: *Radioisotopes, *Fresh water, *Clams, Indicators, Cesium, Strontium radioisotopes, Zinc radioisotopes, Cobalt radioisotopes, Manganese, Chromium, Sulfur, Streams, Effluent streams, Limnology, Spectrometers, Radiochemical analysis, South Carolina.
Identifiers: *Uptake, *Loss, Lampsilis radiata, Savannah River Plant (S.C.), Cerium-144, Soft tissues, Shells, Concentration factors, Biological half-life.

The uptake and loss of radionuclides by the freshwater clam Lampsilis radiata (Gmel), were studied under natural stream conditions at the Savannah River Plant. The species, common to the Savannah River, was found to be a good biological indicator of industrially released radionuclides. Specimens in a reactor effluent stream were exposed for 91 days to very low concentrations of cerium-144, cesium-137, strontium-90, zinc-65, cobalt-60, manganese-54, chromium-51, and sulfur-35, and then transferred to a nonradioactive stream for retention studies. Loss of radionuclides from soft tissues was measured for 56 days. Except for strontium-90, all radionuclides studied were concentrated in the soft tissues; only strontium-90, manganese-54, and cesium-137 were concentrated significantly in shells. At apparent equilibrium, concentration factors for soft tissues were 220 for cesium-137, 240 for sulfur-35, 440 for chromium-51, 790 for cobalt-60, 900 for cerium-144, 2400 for manganese-54, and 4100 for zinc-65. Retention studies showed that the biological half-life of each radionuclide in soft tissues consisted of both short and long-lived components (days): cerium-144 (2.0, 34), cesium-137 (3.0, 38), zinc-65 (3.5, 40), sulfur-35 (4.8, 44) chromium-51 (5.0, 52), manganese-54 (2.8, 81) and cobalt-60 (4.8, 277). Short-lived components represented 34-61% of radioactivity in soft tissues. (Jones-Wis)
W69-08673

UPTAKE OF DIELDRIN BY ISOLATED PERFUSED GILLS OF RAINBOW TROUT,
Michigan State Univ., East Lansing. Dept. of Physiology.
Paul O. Fromm, and Robert C. Hunter.
J Fish Res Board Canada, No 26, p 1939-1942, 1969. 1 fig, 1 tab, 6 ref.

Descriptors: *Dieldrin, *Rainbow trout, Gas chromatography.
Identifiers: Transfer studies, Physiological preparations, Uptake.

Several workers have suggested that fish uptake of insecticides, including dieldrin, occurs primarily via the gills. Uptake of dieldrin by isolated gill-arch preparations was studied, using three perfusates: Ringers solution, TC-199 (Difco), and heparinized plasma. Preparations were exposed to bath solutions of 1000 parts per billion dieldrin in ethanol solution. Transfer of dieldrin from the environmental water occurred only when plasma protein or plasma lipoprotein was present as the perfusate. Transfer was passive. Authors suggest that dieldrin and related insecticides diffuse through the gills and become dissolved in the lipid portion of plasma lipoprotein. Graphical and tabular data include tracings of gas chromatograms and summary of experimental data. (Voightlander-Wis)
W69-08677

MOLTING AND CALCIFICATION IN DAPHNIA MAGNA,
Calif Univ., Berkeley. Sanitary Engineering Research Lab.; and California Univ., Berkeley. School of Public Health.
Donald B. Porcella, Charles E. Rixford, and John V. Slater.
Physiological Zoology, Vol 42, No 2, p 148-159, Apr 1969. 8 fig, 1 tab, 21 ref.

Descriptors: *Crustaceans, *Daphnia, *Calcium, Strontium radioisotopes, Gamma rays, Tracers, Scenedesmus, Bacteria, Temperature, Magnesium, Radioisotopes, Radioactivity, Chlorella.
Identifiers: *Daphnia magna, *Molting, *Calcification, Exoskeleton, Half-life, Genotype, Uniformity level, Illumination, Beta rays, Autoradiographs, Radionuclide uptake, Daphnia schodleri, Observed ratio concept, Radionuclide concentration, Yttrium-90, Carapace.

Calcification in Crustacea is a process limited primarily to deposition of calcium salts in the exoskeleton. Strontium, chemically similar to calcium, is accumulated by various organisms in relation to the calcium concentration. Because one of the radioactive isotopes of strontium (Sr-85) has a relatively long half-life and is a gamma emitter, it is possible to study calcification by observing deposition of Sr-85 at different intervals within a molting cycle. Since almost all the calcium and strontium is localized in exoskeleton, a clear description of some aspects of calcium deposition and molting can be determined by using Sr-85 to study the chemical and kinetic relationships of calcification in whole Daphnia. A hypothesis based on growth rates and relating accumulation to chemical equilibrium between environmental strontium and calcium and deposition sites in the exoskeleton is suggested as explaining calcification. Any factor which affects synthesis or growth, such as temperature, has a direct effect on the calcium accumulation rate. Total accumulation of calcium and strontium is directly related to water concentrations and the differential binding of calcium and strontium. Use of Sr-85 as a tracer for calcium in the calcification process appears to fit the observations. (Jones-Wis)
W69-08678

CONCENTRATIONS OF THE NATURALLY OCCURRING RADIONUCLIDES Ra-226, Pb-210 AND Po-210 IN AQUATIC FAUNA,
Argonne National Lab., Ill. Radiological Physics Div.
Richard B. Holtzman.
Proc 2nd Natl Symp on Radioecology, May 15-17, 1967, Ann Arbor, Mich. US Atomic Energy Comm, Doc CONF 670503, p 535-546. 6 fig, 2 tab, 24 ref. Available from Clearinghouse for Federal Sci and Tech Information as CONF 670503.

Descriptors: *Radioisotopes, *Radium radioisotopes, *Lead radioisotopes, *Aquatic animals, Marine fish, Freshwater fish, Shellfish, Copepods, Hazards, Industries, Tracers, Calcium, Metabolism, Human population, Ecology, Food chains, Biota, Atlantic Ocean, Great Lakes, Pikes, Herrings, Pacific Ocean, Salmon, Clams, Oysters, Alaska, Perches, Age, Potassium radioisotopes, California.
Identifiers: *Polonium radioisotopes, *Concentrations, *Natural occurrence, Seals, Species, Fin whale, Sperm whale, Bone, Tooth, Muscle, Euphasiids, Euphausia pacifica, Anycholeuthis, Biosphere, Radon-222, Half-life, Lead-210-Bismuth-210-Polonium-210, Alpha particle, Life spans, Halibut, Flounder, Scotland, Tuna, Japan, Barrow, Whitefish, Kidney, Blubber, Strongylocentrotus purpuratus, Los Angeles, California, Meganyctiphanes norvegica, Alpha counter, Shell, Spines, Fluids, Soft tissue, Jaws, Anthropods, Exoskeleton, Liver, Cattle, Human bone, Human tissue, Caribou, Reindeer, Baleen, Mandible, Environmental dose, Cosmic rays, Eskimos.

Concentrations of radium-226 (Ra-226), lead-210 (Pb-210), and polonium-210 (Po-210), were determined in hard and soft tissues of freshwater and marine fish, shellfish, seals, whales, and in some dietary components of whales. Concentrations of Ra-226 at about 5 picocuries/100 gram bone ash and 0.2 picocuries/100 gram wet soft tissue were fairly constant among species. Concentrations of both Pb-210 and Po-210 in a given tissue were equal to or greater than those of the parent, Ra-226. In fish and seal bone, concentrations of Pb-210 and Po-210 were similar to those in human bone, about 15 picocuries/100 gram ash. Fish muscle contained about 0.2 picocuries Pb-210/100 gram wet, specific activities of Po-210 about 10-fold greater. Activities of both nuclides in soft tissues of clams, oyster, and squid were higher by one order of magnitude than in fish muscle. In bone and muscle taken from a fin whale, concentrations of these nuclides were similar to those in fish. By contrast, teeth from sperm whales had concentrations of Pb-210 one order of magnitude greater than those in bone of fin whales. Higher concentrations of Pb-210 in sperm whales seem correlated with those found in components of their diet--copepods, euphausiids, and possibly squid. (See also Vol 2, No 18, Field 5C, W69-07441). (Jones-Wis)
W69-08679

ENRICHMENT OF RADIOACTIVITY BY ARCTIC ECOSYSTEMS IN FINNISH LAPLAND,
Helsinki Univ. (Finland). Dept. of Radiochemistry.
J. K. Miettinen.
Proc 2nd Natl Symp on Radioecology, May 15-17, 1967, Ann Arbor, Mich. US Atomic Energy Comm, Doc CONF 670503, p 23-31. 6 fig, 4 tab, 14 ref. Available from Clearinghouse for Federal Sci and Tech Information as CONF 670503.

Descriptors: *Radioactivity, *Ecosystems, *Arctic, Cesium, Iron, Radiochemical analysis, Food chains, Lichens, Freshwater fish, Flood plains, Pastures, Milk, Strontium radioisotopes, Calcium, Potassium, Fallout, Iron, Nutrients, Aquatic populations, Pikes, Lakes, Lead radioisotopes, Arctic Ocean.
Identifiers: *Finnish Lapland, Reindeer, Body burdens, Whole body counting, Polonium-210, Blood, Half-life, Sedges, Horsetails, Cows, Fodder, Caribou, Helsinki, Finland.

Body burdens of cesium-137 for reindeer Finnish Lapps and a control group of southern Finns were determined by whole body counting and by radiochemical analyses of blood samples for iron-55 and polonium-210. While body burdens of the southern population are of the same order as those of western peoples in general, Lapps contain about 50-fold more cesium-137 and 10-fold more iron-55 and polonium-210, due mainly to their food chains: lichen to reindeer meat to man; for cesium-137, fresh water fish to man, and flooded riverside pastures to cow's milk to man. In many Lapland lakes, potassium content is so low that enrichment of cesium-137 by aquatic organisms is greatly increased. Cesium-137 content in pike in 1965 varied from 0.2 to 22 nannocuries per kilogram freshweight as a function of potassium content of the lake water, and similarly in cow's exclusive fodder (water plants, sedges and horsetails) content of cesium-137 varied 100-fold. Cow's milk and meat in Lapland contain about ten times more cesium-137 than in southern Finland. Stable iron in Finnish lakes from 30 to 1500 micrograms per litter, effecting more than 10-fold differences in content of iron-55 in fish. (See also Vol 2, No 18, Field 5C, W69-07441). (Jones-Wis)
W69-08680

INTERACTIONS OF IONIZING RADIATION, SALINITY, AND TEMPERATURE ON THE ESTUARINE FISH, FUNDULUS HETEROCLITUS,
Bureau of Commercial Fisheries, Beaufort, N.C. Radiobiological Lab.
J. W. Angelovic, J. C. White, Jr., and E. M. Davis.
Proc 2nd Natl Symp on Radioecology, May 15-17, 1967, Ann Arbor, Mich. US Atomic Energy Comm, Doc CONF 670503, p 131-141. 5 fig, 4 tab, 22 ref, disc. Available from Clearinghouse for Federal Sci and Tech Information as CONF 670503.

Descriptors: *Radioactivity, *Salinity, *Temperature, *Fish, *Estuaries, Sodium, Oxygen demand, Cobalt radioisotopes, Mathematical models, Time, Regression analysis.
Identifiers: *Fundulus heteroclitus, *LD-50, Efflux, Radiation dose, Osmoregulatory system, Multiple regression analysis.

Estuarine animals are characterized by capacity to adapt to widely varying conditions. The interactions of salinity, temperature, and ionizing radiation as environmental factors affecting mortality, LD-50 (lethal dose for 50% mortality), and sodium-22 efflux of the euryhaline fish, Fundulus heteroclitus, were determined in a series of experiments. Multiple regression analyses were used to derive equations describing effects of all factors that significantly influenced mortality of the fish at three different intervals after irradiation. Temperature effects were significant at all three intervals, and effects of salinity, radiation dose, and temperature-salinity interaction were each significant at one or more of the different times after irradiation. Various combinations of different levels of temperature and salinity yielded different LD-50 values. At the upper end of their temperature range, fish tolerated more radiation at low salinity. At the lower end of their temperature range, this tolerance was reversed. Irradiated fish generally lost sodium-22 more rapidly than unirradiated fish, suggesting that lethal effects of radiation may stem from damage to osmoregulatory capabilities. Gills being vital in regulation of salt and water balance, damage to them could explain inability of irradiated fish to exist at certain temperature-salinity combinations. (See also Vol 2, No 18, Field 5C, W69-07441). (Jones-Wis)
W69-08681

IMPLICATIONS OF RADIOECOLOGY FOR OTHER RESEARCH IN ENVIRONMENTAL CONTAMINATION,
North Carolina State Univ., Raleigh. Inst. of Statistics.
Don W. Hayne.
Proc 2nd Natl Symp on Radioecology, May 15-17, 1967, Ann Arbor, Mich. US Atomic Energy Comm, Doc CONF 670503, p 32-38. Available from Clearinghouse for Federal Sci and Tech Information as CONF 670503.

Descriptors: *Radioecology, *Environmental sanitation, Dynamics, Food chains, Hazards, Fallout, Genetics, Tracers, Pesticides, Damages, Growth rates, Reproduction, Resistance, Carnivores, Trophic level, Domestic animals, Toxicity, Mammals, Birds, Population, Plants, Human population, Biota, DDT, North Carolina, Sampling, Monitoring, Distribution, Kinetics, Lipids, Mathematical models.

Identifiers: *Contamination, *Pollution, Cycling, Survival, Peromyscus, Patuxent Wildlife Research Center, Radionuclides, Biological magnification.

Radioecology has advanced understanding of what happens to material, natural or unnatural, introduced into the biological world and of unfavorable effects of long-term exposure at low levels. Distribution and occurrence of contaminants in food, water supplies, and gross aerial pollution must be studied and an attempt made to sample the world. Also needed is information bearing on kinetics of contamination including all processes whereby materials move within ecosystems, whether between cells of an organism, among organs and physiological pools of organisms, through food chains, or whether transported globally by physical means. In this regard, retention of DDT lipids of the body, apparently under conditions of dynamic interchange is illustrative. Author presents mathematical model for concentration in lipids. Another area for attention is individuals' response to toxicants. There is need of standardized tests of chronic effects on important biological parameters of growth, reproduction, survival, and behavior. Effects of radiation on populations also need study. Strongest argument for laboratory investigation of individual response is the possibility of predicting effects expressed as body burdens or storage concentrations. When field observations can demonstrate such concentrations, interpretation of effects can be made. (See also Vol 2, No 18, Field 5C, W69-07441). (Jones-Wis)
W69-08682

THE SCIENTIST'S RESPONSIBILITY IN THE CONTROL OF MAN'S ENVIRONMENT,
Chet Holifield.
Proc 2nd Natl Symp on Radioecology, May 15-17, 1967, Ann Arbor, Mich. US Atomic Energy Comm, Doc CONF 670503, p 1-8. Available from Clearinghouse for Federal Sci and Tech Information as CONF670503.

Descriptors: *Environment, Pollutants, Nuclear powerplants, Ecology, Fallout, Nuclear explosions, Uranium radioisotopes, Mining, Public health, Effluents, Generators, Water pollution, Costs, Energy, Radioactive wastes, Radioactive waste disposal.
Identifiers: *Scientist's responsibility, Peaceful applications, AEC National Laboratories.

Author discusses ecological issues, especially effects of nuclear explosives on ecosystems from Panama Canal to northern coasts of Alaska and effects of fallout--the Eskimo's problem of body burden accumulations via food chain. Peaceful applications of nuclear explosives demand consultation with ecologist. Uranium miners' exposure to radiation still requires solution. Citizens' revolt against pollution of their environmental demands corrective action. Data affecting health and welfare must be obtained. Remedial action is being slowly instigated. Administrators using results of research must use them properly as improper impressions or conclusions may lead to unsuitable decisions by laymen. Use of nuclear energy may reduce pollution since effluents can be controlled in large measure. Low cost energy from nuclear power plants can be used to purify and reclaim water supplies. Given this clean energy in abundance, railroads could be electrified, sewage pasteurized, cities centrally heated and refrigerated, and almost every urban service fulfilled without pollution. Energy should be considered more in urban planning, even the location of reactors in the heart of cities. Although quantities of nuclear waste would have to be stored, techniques are now being refined for disposal, including storage in salt mines. (See also Vol 2, No 18, Field 5C, W69-07441). (Jones-Wis)
W69-08683

RADIOECOLOGY AND THE FEASIBILITY OF NUCLEAR CANAL EXCAVATION,
Battelle Memorial Inst., Columbus, Ohio. Columbus Labs.
William E. Martin.
Proc 2nd Natl Symp on Radioecology, May 15-17, Ann Arbor, Mich. US Atomic Energy Comm, Doc CONF 670503, p 9-22. 3 fig, 2 ref. Available from Clearinghouse for Federal Sci and Tech Information as CONF 670503.

Descriptors: *Radioecology, *Nuclear engineering, *Canal construction, Ohio, Agriculture, Forests, Fresh water, Ecology, Marine animals, Marine plants, Fallout, Food chains, Hazards, Panama Canal, Atlantic Ocean, Pacific Ocean, Topography, Geologic formations, Hydrology, Hydrography, Biota, Environment, Diseases, Fish, Estuaries, Gamma rays, Tritium, Strontium radioisotopes, Manganese, Calcium, Phosphorus radioisotopes, Iron, Iodine radioisotopes, Cesium, Lead radioisotopes, Soils, Spectrometers, Magnesium, Aluminum, Sodium, Nitrogen, Molybdenum, Cobalt, Sulfur, Carbon, Radiochemical analysis, Rice, Shrimp, Mollusks, Mangrove swamps, Mathematical models.
Identifiers: Columbus (Ohio), Central America, Colombia, External dosimetry, Internal dosimetry, US Atomic Energy Comm, Scandium-46, Ruthenium-106, Cerium-144, Wolfram-181, Plutonium-239, Radionuclide concentration, Zinc, Ecuadorian Institute of Anthropology and Geography, Anthropology, Cavanillesia plantanifolia, Prioria copaifera, Biogeochemistry.

Bioenvironmental and other studies are in progress to evaluate feasibility, from viewpoint of radiological safety, of plans for nuclear excavation of a sea-level canal across the isthmus of Central America. In order to predict external and internal radiation doses to human populations near proposed canal routes, field studies of human, agricultural, forest, freshwater, and marine ecology, have been undertaken in eastern Panama and northwestern Colombia. Results of these studies will be combined with predictions of radionuclide production and initial fallout distribution, for estimating radionuclide transfer through tropical food chains and other environmental pathways leading to man. Estimates will be made of types and quantities of radionuclides to be expected, during and after nuclear excavation, in the external environments and diets of native populations in different parts of two study areas, with calculations of potential radiation doses to man based on these estimates. Due to the nature of the problem, it has been necessary to make broad ecological studies of a fundamental nature. This paper reviews these studies and demonstrates that assessment of potential radiological hazards is dependent upon accumulation of ecological and biogeochemical data and application of radioecological principles. (See also Vol 2, No 18, Field 5C, W69-07441). (Jones-Wis)
W69-08684

PESTICIDES AND POLLUTION,
Bureau of National Affairs, Inc., Washington, D.C.
Sandra C. Bloom, and Stanley E. Degler.
Bur Nat Affairs Environ Manage Ser Rep, 1969. 99 p, 3 tab.

Descriptors: *Pesticides, *Pollution abatement, *Regulation, *Legislation, State governments, Federal government, Toxicity, Pesticide residues, Fishkill, Hazards, Pesticide toxicity, Public health.
Identifiers: Pesticide regulation, Pesticide laws.

Pesticide uses, effects, damages, regulation, and legislation are surveyed. Organizations studying and monitoring pesticides are listed and their work is reviewed. Federal and State regulation and registration of users and producers is discussed. The federal pesticide act of 1947 (amended 1959, 1961, and 1964), a proposed uniform state pesticide act, and regulations under these laws as adopted by the Association of American Pesticide Control Officers are presented. Other legislation is proposed for custom pesticides application. (Knapp-USGS)
W69-08707

OIL POLLUTION: PROBLEMS AND POLICIES,
For primary bibliographic entry see Field 05B.
W69-08752

BEHAVIOR OF ORGANIC CHEMICALS IN THE AQUATIC ENVIRONMENT. PART 2-BEHAVIOR IN DILUTE SYSTEMS,
Washington Univ., St. Louis, Mo. Environmental and Sanitation Engineering Lab.
J. C. Buzzell, Jr., R. H. F. Young, and D. W. Ryckman.
Manufacturing Chem Ass Res Rep, Apr 1968. 81 p, 37 fig, 9 tab, 31 ref.

Descriptors: *Water chemistry, *Organic compounds, *Biodegradation, *Chemical degradation, Oxygen demand, Water pollution effects, Bacteria, Toxicity, Fish, Pesticides, Aqueous solutions, Nitrates, Aquatic microorganisms.
Identifiers: Organic chemical behavior in water.

A research study of the behavoir of organic chemicals in the aquatic environment, was made of dilute systems as found typically in lakes and deep rivers. A standardized method is described for evaluating and predicting the behavior of organic chemicals in this environment. The method was tested with 20 selected organic chemicals and was found to be reliable and reproducible. It is applicable to single compounds, mixtures, and total waste streams, yielding more meaningful results than can be obtained with the Biochemical Oxygen Demand (5-day BOD) test. When used with sound judgment and engineering experience, results obtained with this method should serve as reliable guide to, but not an absolute prediction of, the behavior of organic chemicals under field conditions. In 1966, a literature critique was published on this subject under the authorship of D. W. Ryckman, A. V. S. Prabhakara Rao, and J. C. Buzzell, Jr., which contains 597 references. (Lang-USGS)
W69-08767

HEALTH.
For primary bibliographic entry see Field 06E.
W69-08791

HEALTH.
For primary bibliographic entry see Field 06E.
W69-08792

PESTICIDES: PRESENT AND FUTURE.

Chem Eng, p 133-140, Apr 1969. 8 p, 4 fig, 3 tab.

Descriptors: *Pesticides, Pesticide residues, Pesticide toxicity, DDT, Selectivity, Insect attractants, *Insecticides, *Herbicides, Pollutants, *Chlorinated hydrocarbon pesticides, *Carbamate pesticides, Formulation, *Organophosphorus pesticides, Toxicity, Contamination, *Urea pesticides, Environmental effects, Hazards, Biocontrol, *Pest control.
Identifiers: Biological magnification.

The advantages and dangers inherent in pesticides depend upon toxicity. Pesticide toxicity and residue problems are reviewed. Fundamental requirements for safer and more effective pesticides are selective toxicity, ease of application, and low cost. The production and consumption of pesticides are discussed; the manufacture of some successful pesticides is described, including DDT, Sevin, Vapona, Parathion, and several herbicides. Formulation and safety precautions are covered. New products and new approaches are constantly being sought for existing pesticides that have disadvantages such as erratic selectivity, residue buildup, or food contamination. Biological control is showing promise for insect control, and has advantages over artificial agents in avoiding the specificity and toxicity problems. (USBR)
W69-08843

EFFECTS OF WASTE EFFLUENTS ON THE PLASTICITY OF EARTH MATERIALS,
Illinois State Geological Survey, Urbana.
William Arthur White, and M. Katherine Kyriazis.

Ill Geol Surv Environ Geol Note No 23, July 1968. 23 p, 2 fig, 6 tab, 15 ref.

Descriptors: *Soil disposal fields, *Soil mechanics, *Mechanical properties, *Physical properties, *Expansive clays, Clays, Plasticity, Soil engineering, Foundations, Soil strength.
Identifiers: Effluent effects (Clays).

The effects of waste effluents on the pasticity and strength of some earth materials was evaluated. Because earth materials must support engineering structures such as buildings, dams, and roads, strength changes are potentially dangerous. The Illinois State Geological Survey investigated the effects of soap, detergent, water softener, starch, and fabric softener on 5 natural clays. The effects of the additives on plastic limit, liquid limit, and plasticity index are tabulated. In areas with montmorillonite, effluents may increase swelling by exchanging their sodium for the clay's calcium. Some anionic detergents may increase evaporation rates, which can be advantageous in soil disposal systems. (Knapp-USGS)
W69-08955

THE SUBMERGED AQUATICS OF UNIVERSITY BAY: A STUDY IN EUTROPHICATION,
Wisconsin Univ., Madison.
C. T. Lind, and G. Cottam.
American Midland Naturalist, Vol 81, No 2, April 1969. p 353-369, 4 fig, 6 tab, 16 ref. OWRR Project B-019-Wis.

Descriptors: *Submerged plants, *Aquatic plants, Contour mapping, Eutrophication, Wisconsin.
Identifiers: *Plant communities, University Bay, Lake Mendota, Wisconsin, Quantitative composition, Myrophyllum exalbescens.

The submerged aquatic plants of University Bay, Lake Mendota, Dane County, Wisconsin, were sampled using the line intercept method. Twenty-one lines, perpendicular to the shoreline and extending into the bay to the depth at which growth of submerged aquatic plants ceased were sampled. All plants intercepting the line were recorded within consecutive half-meter segments of the line. The data were used to construct a contour map of the vegetated portions of the bay and to delimit the plant communities. Six plant communities were found. Data on plant height and standing crop were obtained from quadrat samples taken at biweekly intervals from four regions within the bay. The data were compared with studies made in 1922. Marked changes in quantitative composition have occurred since 1922, with the most marked difference being the great increase in Myriophyllum exalbescens and the complete disappearance of several species that were formerly major components of the vegetation. (Lind-Wis)
W69-09010

THE ADSORPTION AND DEGRADATION OF INSECTICIDES BY LAKE SEDIMENTS,
Wisconsin Univ., Madison.
L. N. Newland.
Univ of Wisconsin Water Resources Center Report, 1968. 92 p. OWRR Project B-016-Wis.

Descriptors: *Insecticides, Sediments, Adsorption, Degradation, Pesticides, Public health.
Identifiers: *Lake sediments, *Gamma-BHC, *Parathion, Environmental pollution.

Increased usage of insecticides has led to the accumulation of residues in the environment, thus creating a potential health hazard for fish, wildlife, and humans. The problem is especially acute in lake systems as it leads to the possible pollution of drinking water supplies. All of these factors have necessitated the evaluation of the persistence and fate of insecticides in the environment. In spite of the fact that pesticidal pollution of natural resources has been studied over a decade many facets of the problem are still unexplained, e.g., the long-term effect of pesticides on the quality and longevity of water resources. There are principally three ways by which a pesticide may reach the aquatic environment: (1) runoff from land amended with pesticides, (2) direct application or drift from adjacent spraying, and (3) recharge from contaminated aquifers. After introduction of the pollutant (pesticide) in the environment, its fate is then governed by the physical and chemical characteristics of the compound. If the pesticide remains in true solution, it can remain intact or can be degraded chemically and/or biologically. However, if the compound is adsorbed by the sediment, the pesticide may be detoxified by rendering it unavailable or its rate of degradation may be changed considerably. If the electronic configuration of the molecule is changed by adsorption the rate of degradation of the pesticide is likely to be increased. Conversely, if adsorption results in localization of the pesticide in places inacessable to agencies responsible for its degradation, the rate of degradation may be greatly curtailed. The experiments described in this thesis were initiated to determine the rates and pathways of gamma-BHC and parathion degradation in artificial lake systems. (Author)
W69-09011

ADSORPTION AND DESORPTION OF INORGANIC PHOSPHORUS BY LAKE SEDIMENTS IN A 0.1 MOLAR SODIUM CHLORIDE SYSTEM,
Wisconsin Univ., Madison.
J. D. H. Williams, J. K. Syers, R. F. Harris, and D. E. Armstrong.
Univ of Wisconsin Water Resources Center Report, June 1969, 17p. OWRR Proj B-022-Wis.

Descriptors: *Phosphorus, Sediments, Lake soils, Calcareous soils, Adsorption.
Identifiers: *Lake sediments, *0.1 Molar sodium chloride system, Non-calcareous soils.

Non-calcareous lake sediments generally adsorbed and retained more added inorganic phosphorus than calcareous lake sediments. Sediments which retained the most added phosphorus during adsorption tended to release the least phosphorus during a subsequent desorption at all levels of added phosphorus. The net amount of added phosphorus adsorbed (following adsorption and desorption) was lowest for calcareous sediments, with one exception, at the highest level of added phosphorus (50 micrograms phosphorus/milliliter). The reactions involved in the adsorption and desorption of added phosphorus were not always completely reversible during the time-periods used in the experiment. A close relationship was found between the order of the capacity of a sediment to retain added phosphorus in the laboratory and the levels of native total phosphorus and inorganic phosphorus in the sediment. (Williams-Wis)
W69-09014

FRACTIONATION OF INORGANIC PHOSPHORUS IN LAKE SEDIMENTS: I. RELEASE AND RESORPTION OF PHOSPHORUS DURING FRACTIONATION,
Wisconsin Univ., Madison.
J. D. H. Williams, J. K. Syers, D. E. Armstrong, R. F. Harris, and D. E. Spyridakis.
Univ of Wisconsin Water Resources Center Report, June 1969, 12p. OWRR Proj B-022-Wis.

Descriptors: *Phosphorus, *Distillation, *Wisconsin sediments, Calcareous-soils.
Identifiers: *Inorganic phosphorus fractionation process, *Lake sediments, Southern Wisconsin, Non-calcareous sediments, Resorption.

Procedures for characterizing the forms of inorganic phosphorus in lake sediments are discussed. Sediments were treated with an ammonium reagent containing added inorganic phosphorus to determine the recovery of phosphorus in this and subsequent stages of an inorganic phosphorus fractionation procedure. Total recovery of added phosphorus was 95 plus or minus 8 percent for nine calcareous sediments from southern Wisconsin. All of the phosphorus added to the non-calcareous sediments was recovered in the ammonium and succeeding first sodium hydroxide extracts. In the case of the calcareous sediments added phosphorus was recovered in the first hydrochloric acid, citrate-dithionite-bicarbonate, ammonium sub four fluoride, and second hydrochloric acid extracts, in declining order of importance. Recovery of added phosphorus in several extracts indicates that the interpretation of fractionation results is seriously complicated unless resorption of phosphorus released from the sediment during the extraction is corrected. Resorption can be largely corrected for when fractionating the inorganic phosphorus of non-calcareous but not of calcareous sediments. Little influence of state of sample on percentage recovery values was detected. (Williams-Wis)
W69-09019

FRACTIONATION OF INORGANIC PHOSPHORUS IN LAKE SEDIMENTS: II. FORMS AND AMOUNTS OF INORGANIC PHOSPHORUS,
Wisconsin Univ., Madison.
J. D. H. Williams, J. K. Syers, D. E. Armstrong, R. F. Harris, and D. E. Spyridakis.
Univ of Wisconsin Water Resources Center Report, June 1969, 11 p. OWRR Proj B-022-Wis.

Descriptors: *Phosphorus compounds, *Wisconsin, *Distillation, Phosphorus, Sediments, Calcareous soils.
Identifiers: *Lake sediments, Southern Wisconsin, Non-calcareous sediments.

The forms and amounts of inorganic phosphorus in five non-calcareous and nine calcareous Wisconsin lake sediments were determined using a recently developed fractionation scheme. Total phosphorus ranged from five hundred and eighty to six thousand and ninety parts per million and was usually lower in the calcareous sediments. The proportion of acid-extractable calcium phosphate was higher in the calcareous sediments; with one exception, this fraction constituted eight percent or less of total inorg. phosphorus in the non-calcareous sediments. Only for the calcareous Lake Wingra sediments did easily-soluble phosphorus (ammonium sub four chloride phosphate) exceed five percent of total inorg. phosphorus. The ammonium sub four fluoride phosphate and first sodium hydroxide phosphate fractions were low in the Wingra samples but constituted a higher proportion of total inorg. phosphorus in the others. Over eighty percent of total inorg. phosphorus in two non-calcareous sediments, which were highest in total phosphorus, was present in the first sodium hydroxide extraction. Low values for reductant-soluble phosphorus were obtained for the non-calcareous sediments; the higher values for this fraction in calcareous sediments are thought to be due to the release of inorganic phosphorus adsorbed by carbonate matrices. The second sodium hydroxide phosphate and residual inorg. phosphorus fractions were low in all samples. Values for ammonium sub four fluoride phosphate in the calcareous sediments were affected by state of sample (undried, freeze dried, and air dried). The sum of ammonium sub four fluoride phosphate plus first sodium hydroxide phosphate was independent of sample state and the values for ammonium sub four fluoride phosphate were affected appreciably by sample pretreatment for non-calcareous samples only. Reductant-soluble phosphorus values were influenced by state of sample in some cases. (Williams-Wis)
W69-09020

5D. Waste Treatment Processes

PRACTICAL APPLICATION OF FOAM FRACTIONATION TREATMENT OF LOW QUALITY WATER,
Alaska Univ., College. Inst. of Water Resources.
For primary bibliographic entry see Field 03C.
W69-08690

THE COURSE OF SELF-PURIFICATION PROCESS OF CANALIZED, HIGHLY POLLUTED RIVERS,
For primary bibliographic entry see Field 02K.
W69-08703

DILUTE SOLUTION REACTIONS OF THE NITRATE ION AS APPLIED TO WATER RECLAMATION,
Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio. Cincinnati Water Research Lab.
Frank C. Gunderloy, Jr., Cliff Y. Fujikawa, V. H. Dayan, and S. Gird.
Robert A. Taft Water Res Center Rep No TWRC-1, Oct 1968. 67 p, 14 tab, 232 ref, append.

Descriptors: *Denitrification, *Water chemistry, *Sewage treatment, *Chemical degradation, Nitrates, Ammonia, Reduction (Chemical), Oxidation, Phosphates, Iron compounds, Sulfates, Catalysts, Copper compounds.
Identifiers: Inorganic denitrification.

A new and unexpected partial denitrification of dilute nitrate ion solutions (10 to 50 ppm) was achieved by treatment with 8 moles of ferrous sulfate per mole of nitrate in unbuffered alkaline reactions. The nitrogen loss, which probably represents evolution of nitrogen or nitrous oxide was as high as 50%. Total reduction to lost nitrogen plus nitrate and/or ammonia approached 100%. The reduction takes place in the presence of partially oxidized black iron hydroxides, and requires catalytic quantities of cupric ion. Denitrification is suppressed by phosphates, as well as by several other factors, some as yet unidentified. Silver ion catalysis or a 16-fold excess of the ferrous salt permits reduction to ammonia in the presence of phosphate, but there is no accompanying denitrification. (Knapp-USGS)
W69-08715

POLLUTION CHARGES, WASTE ASSIMILATIVE CAPACITY INVESTMENT, AND WATER QUALITY: THE PUBLIC COSTS OF A PUBLIC GOOD,
Ohio State Univ., Columbus. Dept. of Economics.
For primary bibliographic entry see Field 06C.
W69-08751

SOME ASPECTS OF WATER SUPPLY AND SEWERAGE IN ROMANIA (ROMANIAN),
State Water Committee, Bucharest (Rumania).
Ion Teodorescu.
Hidrotehnica, Gosp Apelor, Meteorol, Vol 13, No 6, p 269-272, June 1968. 4 p.

Descriptors: *Water supply, *Water resources development, *Water resources, *Water quality control, Waste water treatment, Water demand, Water pollution control, Water treatment, Sewage treatment, Sewers, Analytical techniques, Filtration, Coagulation.
Identifiers: *Romania.

The water needs for industry, agriculture and domestic uses in Romania are expected to show a great increase in the future. Examples of recent plans of water resources and development in the country are briefly discussed. Flood control, construction of new lakes and reservoirs, development of new methods for controlling the water quality, control of pollution, and construction of waste treatment plants are only some of the problems which get more and more attention in Romania. Water filtration, decantation, and coagulation, uses of new technological processes, etc., are part of a new and coordinated research and development program. The waste treatment plants need to be modernized and staffed with highly qualified personnel. There is also an obvious need for development of new waste treatment plants and for a better geographical distribution in accordance with industrial and population growth. Above all, water quality and not quantity seems to be the control problem which requires adequate solutions from hydrologists. (Carstea-USGS)
W69-08962

5E. Ultimate Disposal of Wastes

COMMONWEALTH V SONNEBORN (INDUSTRIAL POLLUTION).
For primary bibliographic entry see Field 06E.
W69-08778

5F. Water Treatment and Quality Alteration

STRUCTURE AND VALUES IN LOCAL POLITICAL SYSTEMS: THE CASE OF FLUORIDATION DECISION,
Chicago Univ., Ill.; and State Univ. of New York, Buffalo.
Robert L. Crain, and Donald B. Rosenthal.
(National Opinion Research Center reprint, University of Chicago) Journal of Politics, Vol 28, No 1, Feb 1966. p 169-195.

Descriptors: *Local governments, *Fluoridation, Decision-making, Surveys, Social values.
Identifiers: Community structure.

Previous studies of fluoridation controversies have been limited to analysis of only one city or at most a small number of cities. The research reported here was designed to complement these earlier studies with an analysis which was: (1) frankly political in approach, and (2) based on a large number of cases. Questionnaires were mailed to the local public health officer, the city clerk, and the publisher of the largest newspaper in each of 1,186 cities; 1,051 of these were cities between 10,000 and 500,000 population which (a) did not have fluoride naturally present and (b) were the primary consumers of their water supply. (This excludes many suburbs.) The remaining 75 cities were cities between 5,000 and 10,000 population which had held referenda. From the responses to the questionnaires, it was concluded that fluoridation has the following political properties: (1) it has almost unanimous support among the elite; (2) very few members of the elite have a strong interest in seeing it adopted; (3) the opposition comes from an organized minority, usually including chiropractors, Christian Scientist, natural food faddists, and, in a few cases, the radical right; (4) the public at large is uninformed but is cautious because of the possible side effects of any medical innovation; and, (5) the medical profession is virtually unanimous in support of fluoridation. While each of these statements requires a slight qualification, the general implications seem clear. Fluoridation can be adopted only by cities in which the political and civic elites' mild support is sufficient to offset the virulent opposition of a minority or ordinary citizens, and only when it is possible to keep bounds on the level of public discussion so that the argument does not escalate into a confused debate involving large numbers of the general public. (Fortinsky-Chicago)
W69-08889

EXECUTIVE LEADERSHIP AND COMMUNITY INNOVATION: THE FLUORIDATION EXPERIENCE,
State Univ. of New York, Buffalo; and Chicago Univ., Ill.
For primary bibliographic entry see Field 06E.
W69-08891

POLICIES FOR EFFECTIVE AND ECONOMIC CONTROL OF THE ENVIRONMENT,
Wisconsin Univ., Madison.
I. K. Fox.
Paper presented at the Executive Management Seminar, Washington, D.C., February 7-9, 1969. 22 p.

Descriptors: *Community development, Waste disposal, Planning, Environmental effects, Municipal wastes, Industrial wastes, Rural areas, Preservation.
Identifiers: *Environmental contamination, *Waste management, *Economic control.

This paper is concerned with the physical and biological environment of man and the influences of waste disposal practices, incidental contamination and development upon this environment. Environmental problems arise because many economic activities impose costs or damages on others, many of the effects are difficult to measure in quantitative terms, and numerous uncertainties exist as to the nature and significance of some environmental effects. Environmental problems can be effectively studied in accord with the following classification of situations: (a) wastes and contaminants in urban-industrial areas; (b) patterns of urban design; (c) the effects of contaminants and wastes on the biological environment; (d) degradation of unique natural areas; (e) deterioration of the countryside. Six policy directions are suggested: (1) Foster regional systems for managing wastes and contaminants; (2) Develop economic incentives which encourage environmental preservation; (3) Prohibit use of contaminants having uncertain long range consequences; (4) Ration use of unique environmental areas; (5) Enlarge efforts to preserve the rural countryside; (6) Make better provision for representing the general public in decisions relating to the environment. (Author)
W69-09023

5G. Water Quality Control

OBSERVATIONS AND EXPERIENCES IN THE CONTROL OF ALGAE,
Terrence P. Frost.
J New Hampshire Water Works Assoc, 10 p, Dec 1963. 1 tab, 12 ref.

Descriptors: *Nuisance algae, *Algal control, *New Hampshire, *Copper sulfate, Sewage effluents, Smelts, Fishkill, Crustaceans, Bottom sediments.
Identifiers: *New Hampshire Water Pollution Commission, Algal blooms, Nutrient load, Synthetic detergents, Fish managers, Fish yields, Underwater shock wave, Anabaena, Phygon XL (Dichlone), New Hampshire, Lake Winnisquam, Long Pond, Concord, Boston Lot Reservoir, Lebanon, Wadleigh State Park, Lake Shatutakee, Mascoma Lake, Glen Lake.

Author offers various observations and experiences related to algal control operations in nutrient rich waters by the New Hampshire Water Pollution Commission. Since 1961, about 6,000 acres/year in Lake Winnisquam and others have been treated. Overenrichment of the lakes is due to effluents from municipal and industrial treatment plants not equipped to strip nutrients because of increased operational costs. In controlling algae with copper sulfate, the Commission has encountered some opposition from fish managers wary of its effects on fish populations. Tests run on adult smelt and eggs showed levels applied in algal control were not lethal to fish and may in fact increase fish yields in some lakes. A side effect of copper sulfating is the increased crustacean population which is suppressed by large algal communities. So far in New Hampshire, sampling of bottom muds has shown no accumulations of copper exceeding the levels in untreated lakes. Author mentions many successful projects and only one catastrophe, a massive fish-kill in Boston Lot Reservoir, resulting from a miscalculation of volume and doubling dose of copper sulfate. The Commission plans to experiment with copper sulfating in the future for preventive control. (Ketelle-Wis)
W69-08674

SOME LEGAL AND ECONOMIC IMPLICATIONS OF SEA WATER INTRUSION--A CASE STUDY OF GROUND WATER MANAGEMENT,
California Univ., Davis. Dept. of Agricultural Economics; and California Univ., Davis. Water Resources Center.
For primary bibliographic entry see Field 02K.
W69-08768

WATER SALINITY PROBLEMS: APPROACHES TO LEGAL AND ENGINEERING SOLUTIONS,
Beardsley, Hufstedler and Kemble, Los Angeles, Calif.; and Colorado River Board of California, Los Angeles.
For primary bibliographic entry see Field 02K.
W69-08769

WATER POLLUTION (POWERS OF COMMISSION IN RELATION TO POLLUTION).
For primary bibliographic entry see Field 06E.
W69-08797

WATER POLLUTION CONTROL AUTHORITY--RULES AND REGULATIONS.
For primary bibliographic entry see Field 06E.
W69-08806

COMPREHENSIVE WATER POLLUTION CONTROL PROGRAM.

MD Ann Code art 96A:75-79 (Supp 1968).

Descriptors: *Maryland, *Water pollution control, *Pollution abatement, *Administrative agencies, Water pollution treatment, Legislation, Programs, State governments, Local governments, Sewage treatment, Silt, Acid mine water, Agricultural chemicals, Industrial wastes, Water quality, Water quality control, Interstate compacts, Manpower, Personnel, Training, Technology, Surveys, Data processing, Programs, Legal aspects.

As part of the Comprehensive Water Pollution Control Program, the State Health Department and the Department of Water Resources shall submit a report to the governor on water quality monitoring, data processing and laboratory services needed to meet pollution control needs. The Department of Water Resources shall recommend measures to control pollution from silt, acid mine draining, agriculture drainage and industrial waste. The departments shall submit an annual report to the governor and general assembly on: (1) the status of county water supply and sewerage plans; (2) the status of water quality standards programs; (3) the status of interstate compacts; (4) the status of studies and programs under this subtitle; (5) related federal plans; (6) other state programs. The departments may cooperate with the appropriate agencies for the training of technical personnel for water pollution control. The departments may conduct studies, surveys, investigations, research and analyses and may engage consultants to accomplish the purpose of this subtitle. (Helwig-Fla)
W69-08863

THE ECONOMICS OF REGIONAL WATER QUALITY MANAGEMENT,
Resources for the Future, Inc., Washington, D.C.
Allen V. Kneese.
Baltimore, Johns Hopkins Press, 1964. 215 p.

Descriptors: *Waste disposal, *Water resources, *Cost-benefit analysis, *Cost allocation, Economies of scale, Effluents, Groundwater, Hydrologic aspects, Industrial water, Irrigation, Cities, Planning, Pollution, Public health, Water courses, Lakes, Riparian rights, Streamflow, Reservoirs.
Identifiers: *Ruhr region of West Germany, *Ohio River, Cost minimization, Land use planning.

This book is designed to shed light on how to determine economically optimal region systems for managing water quality and how to devise appropriate institutional forms and tools for management of water quality. To achieve this purpose, both the economic theory of resources allocation and case studies of actual situations are used. An introduction to the scientific and technological aspects of water quality is included, followed by the identification of major waste materials entering watercourses and methods of treating both waste waters and water supplies. Following this discussion is an outline of the economic resources allocation theory as related specifically to waste disposal problems, and especially that of water pollution. The criteria of cost assessment and redistribution are applied to the water quality problem in the Ohio Basin. Regional waste disposal systems are then discussed as water quality control systems which are part of general water resources management and must be planned accordingly. The Ruhr area of West Germany is studied in this respect, previous to a survey of the implications of this area on present and future policy-making. (Murphy-Rutgers)
W69-08981

FEDERAL AID FOR WATER POLLUTION CONTROL.

Md Ann Code art 43, sec 617 (1965), as amended, (Supp 1968).

Descriptors: *Maryland, *Water pollution, *Water pollution control, *Federal government, Public health, Pollution abatement, Treatment facilities, Wastes, Sewage, Water pollution treatment, Legislation, Cost sharing, Grants, Costs, Financing, Construction, Legal aspects, Construction costs.
Identifiers: *Federal Water Pollution Control Act.

The State Board of Health is designated as the State Water Pollution Control Agency. The Board is vested with the authority to comply with the federal government under the Federal Water Pollution Control Act. This act provides grants to the states to assist them in meeting the cost of establishing and maintaining adequate measures for the prevention and control of water pollution, including grants for the construction of treatment works to prevent the discharge of untreated or inadequately treated sewage or other waste into the waters of the state. No other state agency may exercise the powers hereby vested in the State Board of Health. (Shevin-Fla)
W69-09013

06. WATER RESOURCES PLANNING

6A. Techniques of Planning

OPTIMIZING CONJUNCTIVE USE OF GROUNDWATER AND SURFACE WATER,
Utah State Univ., Logan. Dept. of Civil Engineering.
James H. Milligan.
Utah State Univ Water Res Lab Rep, June 1969. 157 p, 19 fig, 19 tab, 60 ref, append. OWRR Proj No B-013-UTAH.

Descriptors: *Systems analysis, *Conjunctive use, *Surface waters, *Groundwater, *Utah, Mathematical models, Linear programming, Optimization, Stochastic processes, Probability, Planning, Water management (Applied), Water resources development, Computer programs.
Identifiers: *Conjunctive use optimization.

Mathematical models for groundwater and surface-water systems are formulated and solved on a digital computer using linear programming for optimizing the water use of the system. Post-optimal analysis, including sensitivity analysis of the objective function coefficients and right-hand side terms, is also applied to the models. The models which are developed include a general deterministic model, a general stochastic model in which hydrologic inputs are allowed to be probabilistic, and models of two simple, but real, river basins. The advantages of linear programming analysis are demonstrated by the computer solutions which can be obtained by this method of optimization. The method is shown to be effective as a guide to optimal water resources systems design and planning. (Knapp-USGS)
W69-08742

URBAN WATER RESOURCES RESEARCH,
American Society of Civil Engineers, New York. Urban Hydrology Research Council.
For primary bibliographic entry see Field 04C.
W69-08743

WATER RESOURCE ECONOMICS RESEARCH IN THE SOUTHEAST,
Economic Research Service, Washington, D.C.
George A. Pavelis.
Institute of Food and Agricultural Sciences, The University of Florida, Pub No 3, p 89-104, Dec 1967. 16 p, 1 tab, 13 ref.

Descriptors: *Resource development, Programs, Systems analysis.
Identifiers: *Southeast U.S.

First, water resources economics and economic research is placed in a logical context to indicate the dimensions of the problem. Next, some national research programming efforts to direct public and scientific attention to water resource questions are examined. Finally, some observations are made of how the subject of research needs in the Southeast can itself be treated as an economic problem. (Grossman-Rutgers)
W69-08966

WATER RESOURCES SYSTEMS ANALYSIS,
North Carolina Univ., Chapel Hill. Natural Resources and Planning.
Maynard M. Hufschmidt.
Dept of Environ Sci and Eng, Pub No 138, Nov 22, 1966. 11 p, 1 tab, 11 ref.

Descriptors: *Systems analysis, Planning, River basin development.
Identifiers: *Sub-systems, *Typology.

The notion of comprehensive multi-purpose river basin planning implies a systems approach. A subsystem is a set of functionally related elements which can feasibly be analyzed as an entity, and which can be tied effectively to a larger system by means of well-defined links. Two broad classes of sub-systems are (1) physical-technologic, and (2) social-economic. A typology of sub-systems for water resources is developed. A listing of bibliographical references is included. (Grossman-Rutgers)
W69-08968

THE IDENTIFICATION PROBLEM AND THE VALIDITY OF ECONOMIC MODELS,
Simon Fraser Univ., Burnaby (British Columbia).
L. A. Boland.
South African Journal of Economics, Vol 36, No 3, p 236-240, Sept 1968. 5 p.

Descriptors: *Model studies, *Planning, Mathematical model, Economics, Costs, Benefits.
Identifiers: *Identification problem, Model validity, Model construction, Stochastic models, Exogenous variable, Endogenous variable.

The article is concerned with the benefits and costs of a particular aspect of the decision concerning the construction of an economic model. The author feels most econometricians implicitly ascribe to the conventionalist theory of knowledge, i.e., truth is only a matter of convention. He cites as proof of this the concern shown towards the problem of identification. The epistemological problem pertaining to the validity of the model is logically prior to the problem of identification. The solution to the identification problem amounts to the avoidance of a solution which remains invarient under transformations of the co-ordinates. The author thus concludes that the uniqueness property of identification implies a lack of invariance. Due to the importance of econometric analysis and econometric models in water resource planning and analysis this article should prove useful to empirical researchers in the water area. (Murphy-Rutgers)
W69-08976

OPTIMAL MATHEMATICAL MODELS IN PLANNING THE DEVELOPMENT OF A BRANCH AND IN TECHNICAL POLICY,
L. Kantorovich.
Problems of Economics, Vol 11, No 3, p 3-16, Jul 1968. 14 p.

Descriptors: *Mathematical models, Planning, Linear programming, Resources, Model studies, Depreciation, Demand, Prices.
Identifiers: *Branch models, *Branch management, Development, Technical policy, Optimal models, Nonlinearities, Indivisibilities, Multiproduct models, Output, Indices.

The return to the branch management of industry and its elevation to a new level create conditions favorable to the scientifically substantiated resolution of the problem of branch development. In this area, considerable use must be made of mathematical methods and models as well as the analysis and calculations based on them. At the present time widespread use is being made of the simplest optimal models of the development and location of branches; models calculated by linear programming methods and which in many cases are resolved on the basis of algorithms. The basic advantage of these models over the traditional system of isolated economic analysis for individual enterprises and of the balancing of production and demand is the complex approach in which there is a simultaneous joint analysis of the nation's total demand and of the production potentialities of all enterprises in a branch (existing and projected). This makes it possible to achieve an optimal combination of the interests of producers and consumers. These models can be applied to day-to-day planning of economic policy and management in the water resource area. (Loeb-Rutgers)
W69-08986

6B. Evaluation Process

WATER AND METROPOLITAN MAN, AN ENGINEERING FOUNDATION RESEARCH CONFERENCE,
William Whipple, Jr.
In Water and Metropolitan Man, An Engineering Foundation Research Conference, ASCE Urban Hydrology Research Council Summary, p 11-14, 1968.

Descriptors: *Social impact, Systems analysis, *Social needs, *Social values, Urban planning, Water resources development, Upstream, Downstream, Competing uses, Legal aspects.
Identifiers: *Interdisciplinary approach.

A multi-disciplinary approach to urban water resources development poses certain problems, including role conflicts and the status of the engineer vis-a-vis other disciplines. One of the most pressing legal problems in metropolitan water resources is the upstream-downstream situation. There is a need to codify much of the common law relating to water. The sustems approach to metropolitan water resources development is suggested as a method of achieving progress. Different objectives cause tensions in maximization processes because of the varying degree to which persons are benefited. Rational criteria for selection of projects is necessary; these criteria require the quantification and/or identification of impacts, direct and indirect. Determining the desires of society is often complicated by the fact that there are multiple interests. Reconciliation of these often conflicting needs require the development of a sophisticated methodology for measuring values and needs. (Starr-Chicago)
W69-08629

REFLECTIONS ON THE RELATIONSHIPS BETWEEN SOCIAL SCIENCE AND HYDROLOGICAL ENGINEERING,
Colorado State Univ., Fort Collins.
Duane W. Hill.
In Water and Metropolitan Man, An Engineering Foundation Research Conference, ASCE Urban Hydrology Research Council, Appendix D, p 87-90, 1968.

Descriptors: *Social change, *Social values, Social needs, Psychological aspects, Urban sociology, Water resources development, Aesthetics, Social impact, Decision-making, Research and development.
Identifiers: *Social costs, *Social benefits.

Since engineering facts have deep social consequences, the author contends there is no excuse for the failure of engineers and social scientists to collaborate in their research efforts. There is a need to know how engineering feats and technological transformation affect and direct the social system. The social scientists can be of the greatest help to the engineer in developing and refining measures for quantifying social values, social costs and social benfits. Eight critical needs for research are outlined: (1) information on how legal systems relate to and affect both engineering and/or social systems; (2) effects of both public and private decisions and a greater delineation between the responsibilities of the two sectors; (3) ways for consolidating water resource administration; (4) analysis of planning and planning behavior; (5) develop criteria for preserving engineering, safety and aesthetic values; (6) knowledge about the formulation and behavior of public and decision-making coalitions; (7) knowledge about the roles and impacts of those roles or urban hydrology in the model city programs; and (8) knowledge about what motivates publics and their decision makers. (Starr-Chicago)
W69-08631

SOCIOLOGICAL AND SOCIAL PSYCHOLOGICAL FACTORS RELATED TO METROPOLITAN WATER RESOURCES DEVELOPMENT,
Utah State Univ., Logan.
Wade H. Andrews.
In Water and Metropolitan Man, An Engineering Foundation Research Conference, The ASCE Urban Hydrology Research Council, Appendix C, p 79-86, 1968.

Descriptors: *Social change, Social needs, Social values, Psychological aspects, Urban sociology, *Water resources development.
Identifiers: *Community structure, Interdisciplinary studies.

The need for an interdisciplinary approach to metropolitan water resources development is acknowledged and the problem of communication between disciplines is seen as a real obstacle to the development of such an approach. Examples of sociological theory and analysis that could be applied to the problems of water are: values; social organization; social action; the process of diffusion of ideas; and research methodology. Values relating to one thing, as in the case of economic maximization may be outweighed by other values and choices cannot be made based on rational economic goals. Research on social organization and analysis of community structure and decision-making processes are useul for predicting social behavior. Social action has been studied by sociologists and a model containing five components has been identified. These components are: (1) convergence of interest; (2) establishment of an initiating set - including those with the right to initiate and those with the obligation to respond; (3) legitimation and sponsorship; (4) establishment of an execution set and mobilizing of community group resources; and (5) fulfillment of the objective of the initiating set - or carrying out of the programs. Urban water resources development is seen as being integrally connected with other social processes. All elements of an urban system must be related to any major resource development if archaic social and economic patterns are to be changed. (Starr-Chicago)
W69-08632

WATER SUPPLY STUDY: WARE RIVER AREA.
Central Massachusetts Regional Planning Commission.

Central Massachusetts Regional Planning Commission Report, June 1969. 86 p, 17 tab, 12 fig.

Descriptors: *River basin development, *Water supply, *Water quality, Future planning, Drainage engineering, Surface-groundwater relationships, Population growth rates.
Identifiers: Central Massachusetts Regional Planning Commission, Worcester (Mass) metropolitan area, Comprehensive planning, Ware River.

The study area for this drainage basin study covers the northwestern edge of the Worcester metropolitan area. The purpose of this report was to provide a comprehensive plan for the development of public water supply systems to serve the study area's expected future needs. Future needs of the area were based on data developed by the Central Massachusetts Regional Planning Commission. The data indicate that up to the year 2000 a population increase of only 40 per cent can be expected and most of this will occur in and around the present population centers. Potential sources for future supplies identified and alternative supply solutions are suggested. Five recommendations are made: (1) Engineering investigations be conducted in areas recommended for well development, and these areas be reserved for development as recommended in the proposed plan; (2) Engineering studies on existing or future water systems be conducted when development or expansion of the system is needed; (3) Implementation of any programs recommended for 1970 be initiated immediately; (4) Engineering aspects of allocation of water from Muschopauge Pond be further evaluated in a regional study including the entire Central Massachusetts Regional Planning District; and (5) The recommended plan and program be evaluated and updated within ten years. (Starr-Chicago)
W69-08637

A GENERAL SUMMARY OF THE STATE OF RESEARCH ON GROUNDWATER HYDROLOGY IN DESERT ENVIRONMENTS,
Arizona Univ., Tucson.
For primary bibliographic entry see Field 02F.
W69-08688

A LONG RUN FINANCIAL PLANNING MODEL FOR SMALL WATER SERVICE UTILITIES IN MISSISSIPPI,
Mississippi State Univ., State College. Water Resources Research Inst.
A. A. Armenakis, and G. T. Peden, Jr.
Completion Report to the Office of Water Resources Research, Department of Interior, June 1969. 51 p. OWRR Proj No A-025-MISS.

Descriptors: *Water rates, Model, Financial planning, *Pricing methods, Water systems.

The purpose of this study was twofold. The first was to determine if the pricing practices of small communities in Mississippi were financially and economically sound when related to each community's goals and demands. The second purpose was to design a long-run water rate model that could be effectively used to compute a single water rate that would reflect the time value of money and also meet certain requirements as prescribed by the water service utility. A mail questionnaire was designed specifically to assist in determining whether current pricing policies were consistent with sound economic and financial theories. After sending an initial questionnaire to 89 municipalities and two follow-up questionnaires to those reluctant to cooperate, 42 water utilities responded. The most important observation was that a condition of inadequate long-range financial planning existed in the overwhelming majority of utilities. To overcome this financial inefficiency a model was developed by the authors that could be used by a

small water utility in setting water rates commensurate with sound financial and economic theories. This financial planning model comprises a combination of two pricing methods set forth in the study. In all, three methods were developed. However, given certain requirements as prescribed by the municipality, the water utility can select a method from the payout method or rate of return method and utilize the chosen method in conjunction with the planned revenue approach method. The result is a financial planning model which meets prescribed requirements and reflects the time value of money. (Author)
W69-08691

GENERALIZED PARTICIPATION OF VOLUNTARY LEADERS IN LOCAL WATERSHED PROJECTS,
Mississippi State Univ., State College. Water Resources Research Inst.
K. P. Wilkinson, and R. N. Singh.
Completion Report to the Office of Water Resources Research, Department of Interior, July 1969. 48 p. OWRR Proj No A-028-MISS.

Descriptors: Social science, Organization, Community, Attitudes.

The relationship between participation in watershed development projects and in general community activities and organizations was examined. Names and addresses of 335 members of official boards of water management districts in Mississippi were secured from the state office of the Soil Conservation Service. A questionnaire designed to measure extent and intensity of participation in water management generally, in a specific local watershed development project, and in community activities was mailed to each board member. Completed questionnaires were received from 197 respondents. All measures, including three Guttman-type attitude scales, were coded for computer analysis. Cross-tabulation tables were constructed and chi square and gamma tests were performed to examine the relationship between each of five indicators of the dependent variables (participation in the watershed project) and the independent variables. Findings were generally consistent with theoretical predictions, to wit that scope and level of participation in watershed development is positively related to generality of the community role of the actor. Practical implications of this finding and of the theory which it supports are elaborated in the completion report. (Author)
W69-08692

THE IMPACT OF RESERVOIRS ON LAND VALUES: A CASE STUDY,
Mississippi State Univ., State College. Water Resources Research Inst.
D. C. Williams, Jr., and D. L. Daniel.
Completion Report to the Office of Water Resources Research, Department of Interior, June 1969. 32 p. OWRR Proj No A-026-MISS.

Descriptors: Reservoir, Land values, Land prices.

This study was deemed important due to the number of reservoirs either being constructed or in the planning stage at the present time. The creation of a reservoir and the taking of land for purposes of a reservoir ultimately cause changes in land usage and land values. These changes are of interest to: (1) those whose land is acquired, (2) those whose land use and/or value are directly or indirectly affected, (3) the organization or agency responsible for making the benefit-cost analysis for the project, and (4) the general public who must pay for many such projects through taxes. For purposes of this study, land prices were defined as market sales prices and land values were defined as the capitalized values of the income stream of land. Large increases in land prices were found to have occurred in the five years after the announcement of the reservoir site in a sample area near the reservoir. However, multiple regression analysis indicated factors other than the reservoir may have played important roles in causing the high prices. The most important of these factors was proximity to and growth in a large city. Changes in values and prices of land which could be attributed to the reservoir occurred in areas where the reservoir caused a shift in land use. Little or no increases in the productivity of land occurred in existing uses of land. Productivity increases occurred when land use shifted. The characteristics of the reservoir and surrounding land areas in general determined the extent of changes in land use as a result of the reservoir. In this case, a buffer zone of about 18,000 acres was acquired with the reservoir. It is held by a public agency for controlled development. This factor limited the measurable effect of the reservoir on land values as determined through market forces. (Author)
W69-08693

NUCLEAR ENERGY AND THE AGRO-INDUSTRIAL COMPLEX,
Oak Ridge National Lab., Tenn.
For primary bibliographic entry see Field 03F.
W69-08840

THE ROLE OF RESEARCH AND OPTIMIZATION IN REDUCING THE COST OF HYDRO DEVELOPMENTS,
Bechtel Corp., San Francisco, Calif.
Harry Sutcliffe, and Michael D. Hayes.
Pap, Amer Soc Civ Eng Nat Meet Water Resour Eng, New Orleans, La, Feb 1969. 22 p, 6 fig.

Descriptors: *Hydroelectric power, Costs, *Optimization, Recreation, Pumped storage, Benefit-cost ratios, Technology, Research facilities, Research and development, Cost-benefit analysis, Electric power, Production, Economics, Reliability, Projects, Feasibility, Engineering, Investigations.
Identifiers: Pollution control, *Cost savings.

Areas in which improved technologies can control hydro development costs are examined. The changing role of the hydro project is discussed and areas for new research are suggested. The contribution of optimization technique in maximizing return to an owner is reviewed in the light of increasing pressures for more recreation, pollution control, and other nonrevenue-producing features. A wider benefit-cost ratio, that of benefit to the community as a whole rather than to the owner, must be optimized when considering a project. Sharing research data can benefit technology and reduce costs. The need for a domestic research center capable of testing turbines, pumps, valves, energy dissipators, and measuring large flows is discussed. (USBR)
W69-08855

REGIONAL GOALS AND THE PLAN.
Northeastern Illinois Planning Commission, Chicago, Ill.

IN Diversity Within Order, Northeastern Illinois Planning Commission, Chicago, Ill, March 1967, p 53-55.

Descriptors: Estimated benefits, Economic impact, Social mobility, Aesthetics, Parks, Economic efficiency, Land use, Water demand.
Identifiers: Chicago, Northeastern Illinois, Illinois.

Chapter V evaluates the Finger Plan for the Chicago metropolis on the basis of its achievement of economic, social, and physical regional goals. In terms of economic health, industrial sites should have good access to labor markets, and suppliers. In terms of social mobility, the improved mass transportation system will allow the poor to easily reach places of employment, as well as other facilities. In terms of physical attractiveness, health, and convenience of the region, parks and open spaces, are placed close to the concentration of population. Under the proposal plan, one can change jobs inside the region without having to move to a new home. The plan utilizes the surplus capacity of railways, thus keeping expense at a minimum. Linear development permits public utilities with excess capacity to be extended from established communities. In terms of optimum use of natural resources the plan provides large natural settings close to populated areas. The concentration of water demand may exceed ground water supplies, but the arrangement of population centers facilitates the use of Lake Michigan water. (Gossen-Chicago)
W69-08876

THE FINGER PLAN - A CONCEPT OF ORDER.
Northeastern Illinois Planning Commission, Chicago, Ill.

IN Diversity Within Order, Northeastern Illinois Planning Commission, Chicago, Ill, March 1967. p 15-39, 12 fig, 7 ref.

Descriptors: *Flood Plain Management, *Landfills, *Area redevelopment, Urban areas, Highways, Railroads, Public benefits, Industries, Conservation, Land use, Water storage.
Identifiers: *Chicago, Residential communities, Northeastern Illinois, Historic sites.

Chapter III describes the Finger Plan for the Development of the metropolitan six-county area of Chicago. Its development pattern resembles a hand whose palm is solidly urbanized and whose fingers form strings of communities. The skeleton of the hand is the transportation system featuring a complementary system of expressways, rapid transit rail lines, and commuter rail lines. Each finger is formed linearly by a passenger rail line and/or an expressway. Major regional centers of activity, i.e. universities, large hospitals, industrial parks, and shopping centers are regularly spaced along transportation systems of the palm and the fingers. Residential communities containing their own educational, neighborhood shopping, and recreation facilities fill out this skeleton. Major recreation parks, golf courses, cemeteries, agriculture, and large lot residential areas are located between the fingers. There are six principal development policies, relating to transportation, regional centers, open space, industry, residential communities, and natural resources. Each is discussed at length. Conservation of land, air, and water resources is recommended. Lands subject to flooding, poor drainage, and unstable soil conditions are unsuitable for urban use. Appropriate lands for refuse disposal sites, water storage sites, of special scenic or historic value, and of mineral deposits must be identified. (Gossen-Chicago)
W69-08877

ESTABLISHING PRIORITIES FOR PUBLIC INVESTMENTS,
Office of the Secretary of the Army, Washington, D.C. Systems Analysis Group (Civil Functions).
Jim J. Tozzi.
Systems Analysis Group (Civil Functions), Office Secretary of the Army, June 1969, Washington, DC. 21 p, 8 ref.

Descriptors: *Economics, *Investment, *Cost analysis, *Government finance, *Social participation, Area redevelopment, Water resources development, Project planning, Cost benefit analysis, Cost benefit ratio, Economic efficiency, Economic impact, Social values, Social aspects, Social impact, Social need.
Identifiers: Appalachian Water Resources Program, Objectives.

This paper proposes to outline a methodology which highlights, for any proposed investment, its contribution to the well-being of some groups, its detrimental effects on other groups and an alternative use of the same resources. This process, which is based on the establishment of priorities, consist of four steps: specifying the objectives to be attained; assessing the contribution the investment makes toward the fulfillment of each objective; as-

sessing the cost of the investment; and soliciting public reaction to the proposed investment. The execution of this process implies the need to make value judgments; judgments whose implications must be clearly presented to the general public. Each of the four steps is described with an emphasis on questions of economic methodology. In addition, each step is illustrated by examples from water resource investment projects. Among the salient conclusions were: the need to replace benefit-cost ratios with other indices which measure specific effects of investment; the complete identification of effects of public investment will likely cause changes in program content; and knowledge of effects of public investment will prevent the unequal or unfair distribution of benefits. (Davis-Chicago)
W69-08890

WILL A LAKE AIRPORT BEST SERVE THE CHICAGO AREA.

Open Lands Project, Chicago, Sep 1968. 56 p, 3 illus, 3 append.

Descriptors: *Lake Michigan, *Water management, *Water pollution, *Recreation, *Social values, Oil wastes, Pollutants, Recreation facilities, Political aspects.

This report presents a number of arguments against the construction by the City of Chicago of a proposed large airport in Lake Michigan. Although this paper deals with many factors not related to water, a number of points is made regarding water management problems in an urban context. The following topics were discussed in detail: comparison of site costs, population growth factors, political implications, time schedule, construction problems, airport and runway orientation, air safety, noise hazards, ground traffic accessibility, air pollution, water pollution, effects on recreational boating, related commercial developments, and civic beauty. A number of conclusions related to water management was made. Construction of a polder-type lake airport would contribute to two types of water pollution assuming airport runoff is treated, pollution from aerosol-type exhause from jet aircraft, and pollution effects caused by the disruption of lake circulation patterns. Transportation causeways as well as the airport itself would be detrimental to recreation uses of the lake. Finally, the construction of an airport in Lake Michigan would seriously impair the value of the city's only unique natural resource. (Davis-Chicago)
W69-08892

STUDY OF INDUSTRIAL GROUND-WATER RESOURCES IN THE TSURUGA PLAIN, FUKUI PREFECTURE (JAPANESE),
Industrial Science and Technology Agency, Kawasaki (Japan). Geological Survey.
For primary bibliographic entry see Field 02F.
W69-08895

ENVIRONMENTAL ASPECTS OF RIVER BASIN PLANNING,
North Carolina Univ., Chapel Hill. Dept. of Environmental Sciences and Engineering.
Maynard M. Hufschmidt.
J of the Hydraulics Div, Proc of the Amer Soc of Eng, Vol 93, No HY6, Proc Paper 5605, p 323-333, Nov 1967. 11 p, 21 ref.

Descriptors: *Resources, *Hydraulics, Rivers, Systems, Analysis, Cost-benefit analysis.
Identifiers: Environmental quality, Comprehensive planning.

Current methods and administration of river basin planning must be changed substantially to accommodate the increasing national concern for problems of environmental quality. Modifications will be required in planning theory: improvement of environmental quality should be adopted as a major national objective, along with the objectives of economic efficiency and income distribution. Changes are also needed in methods of computing benefits, cost and production functions, and in the planning process and techniques. Systems analysis methods must incorporate many environmental quality parameters and alternative development and management measures. Planning for river basins and for metropolitan areas must be integrated. Important changes required in water resources policy, organization and administration are discussed. (Grossman-Rutgers)
W69-08969

SOME DEVELOPMENT POTENTIALS OF THE NATURAL RESOURCES OF THE ATLANTIC COASTAL PLAINS,
North Carolina Univ., Chapel Hill. Dept. of Environmental Sciences and Engineering.
Maynard M. Hufschmidt.
Econ Dev Potentials of the Atlantic Coastal Plains Reg, Agr Policy Inst., North Carolina State Univ., Series 26, p 51-53, June 1967. 3 p, 1 ref.

Descriptors: *Conservation, Public benefits, Long-term planning, Project planning.
Identifiers: *Environmental quality, *Environmental deterioration.

Policy makers must be careful to ensure that economic development does not detract significantly from scenic, historic and environmental values. The absence of major mineral deposits in the region is to the advantage of the environmental quality of the region. Another resource issue relates to the value from both the regional and national point of view of preservation as ecological preserves of major portions of the swamps and estuaries of the region. Thirdly, there is the question of how high the quality of the environment should be maintained. Through rational planning principles and techniques a balance between development and preservation which will be for the long range benefit of the region and the nation can be achieved. (Grossman-Rutgers)
W69-08970

RISK, IMPERSONALITY, AND THE SOCIAL WELFARE FUNCTION,
Delhi School of Economics (India).
Prasanta K. Pattanaik.
Jour Pol Econ, Vol 76, No 6, p 1152-1169, Nov/Dec 1968. 18 p, 1 fig, 1 tab, 17 ref.

Descriptors: *Welfare, *Risks.
Identifiers: *Individual preferences, *Subjective preferences, *Social welfare function, *Preference patterns, *Ethical preferences, Intransitivity, Expected utility.

The concept of 'ethical preferences' as developed by Harsanyi (1955) is persuasive enough to justify the qualification 'ethical', and it is the combination of risk and the 'extended sympathy' type of comparison which accounts for this persuasiveness. Ethical preferences can be used as the ingredients for deriving social preferences, and in some respects this procedure is more appealing than the Arrowian procedure of deriving social preferences from the individual's 'subjective preferences.' Granted that individual 'ethical preferences' can be represented by von Neumann-Morgenstern utility indexes this in itself does not solve the problem of aggregation, because 'ethical preferences' will not necessarily be identical for different individuals. The problem of reducing different individual's welfare indexes to a comparable basis is serious in view of the uniqueness only up to linear transformation of the von Neumann-Morgenstern indexes. No less serious is the fact that Harsanyi's 'ethical preferences' may not at all satisfy the von Neumann-Morgenstern or the Marschak axioms. The axioms of 'reduction of compound lottery' and of 'complete ordering' are particularly open to serious doubts of a type that does not arise with 'subjective preferences.' If a social welfare function could be satisfactorily derived, this condition would improve efficiency of decisions concerning allocation of resources, including water resources. (Sokoloff-Rutgers)
W69-08974

PERSPECTIVE ON CONSERVATION ESSAYS ON AMERICA'S NATURAL RESOURCES,
Resources for the Future, Inc., Washington, D.C.

The Johns Hopkins Press, Baltimore, 1958. 260 p. Henry Jarrett, Editor.

Descriptors: *Conservation, *Natural resources, Resource development, Resource allocation, Technology, Costs, Demand, City planning, Oil attitudes, Land, Water resources, Mineralogy, Energy, Recreation, Fish management, Wildlife management.
Identifiers: Science, Malthus, Living standards, Value problems, Urban growth, Resource policy, Laissez faire, Social structure.

The aim of this book, as of the Resource for the Future Forum on which it is based, is to bring expert opinion to bear upon a few resource problems of wide interest and significance. Specifically, the book seeks to shed light on some of the resource conservation problems of the next fifty years from the vantage point of a critical review of the past fifty. In using the past as a springboard for appaising the present and future, hard questions arise and the essays in this book explore some of them. For example, what forces during the past fifty years have shaped American concepts of conservation and attitudes toward it. What have been the really important issues and trends in land and water, minerals and energy, outdoor recreation, and fish and wildlife management. How have resource development policies and programs affected the nation's economy, political life, and social structure--and vice versa. Most important of all, what guidance does the record of the past offer for the future. (Loeb-Rutgers)
W69-08975

MEASURING THE RATE OF RETURN ON CAPITAL,
Sheffield Univ. (England).
A. A. Sampson.
Jour of Finance, Vol XXIV, No 1, p 61-74, Mar 1969. 14 p, 4 tab, 13 ref, append.

Descriptors: *Regression analysis, *Capital, Financial analysis, Profit, Time-series analysis, Long-term planning, Investment, Marginal productivity.
Identifiers: *Distributed lag model, *Rate of return, Cross section analysis, Discounted cash-flow, Time profile, Price changes, Capital-labor ratio.

This paper presents the results of an attempt to estimate the rate of return on capital via regression analysis of financial data. A model relating current profits to current and lagged inflows of long-term capital is considered and fitted to a set of data from the British Mechanical Engineering Industry. Both time-series and cross-section data are used. Acquisitions of long-term capital are measured by summing depreciation provisions, retained earnings and receipts from issues of ordinary shares and instruments of long-term debt. The motivation behind the exercise described in this paper is a feeling that microeconometric analysis might provide useful information about financial performances in the industrial sector. The discounted cash-flow rate of return on capital is one of the most important dimensions of financial performance, and increasing emphasis is being placed on it in the literature on management and decision-making. This approach might be useful in determining the rate of return on capital invested in water resource projects. (Author)
W69-08977

PROBLEMS IN THE COOPERATIVE ALLOCATION OF PUBLIC EXPENDITURES,
Maryland Univ., College Park; and Urban Inst., Washington, D.C.

Martin C. McGuire, and Harvey A. Garn.
Quart Jour Econ, Vol LXXXIII, No 1, p 44-59, Feb 1969. 16 p, 4 fig.

Descriptors: *Resource allocation, *Cost sharing, Federal project policy, Welfare, Multiple purpose, Cost-benefit analysis.
Identifiers: *Public expenditure, *Grants-in-aid, *Project selection criteria, Joint products, Budget constraint, Subsidy, Acceptance curve, Pareto optimal behavior.

Problems of cost sharing between federal agencies or between grantor and grantee derive from the fact that, generally, more than one public agency will contribute to the cost of a single project. At least two levels of government--federal and local--will share in a project's cost; often two or more agencies of the federal government will contribute to the same project, and for different objectives. Hence, joint products and multiple objectives are inherent in the resource allocation decisions discussed in the paper. Short of specific reorganization to achieve this goal, the individual decision maker can only single out a few other agencies to 'coordinate' with. In view of the fact that major interdependencies of this kind exist among recent Great Society programs, the possible losses due to nonoptimal behavior by government agencies could be substantial, even more so now with total annual expenditures for project oriented activities now approaching $17 billions. Therefore, attention given to coordination of federal programs should include much more detailed empirical analysis directed at establishing the best division of authority for sub-optimization. The above is especially applicable to the case of water programs which involve many interdependencies of efforts among governmental agencies at all levels. (Sokoloff-Rutgers)
W69-08979

THE ECONOMICS OF REGIONAL WATER QUALITY MANAGEMENT,
Resources for the Future, Inc., Washington, D.C.
For primary bibliographic entry see Field 05G.
W69-08981

INPUT DEMAND FUNCTIONS FOR THE PROFIT-CONSTRAINED SALES-MAXIMIZER: INCOME EFFECTS IN THE THEORY OF THE FIRM,
Balliol Coll., Oxford (England).
R. D. Portes.
Economica Vol XXXV, No 139, p 233-248, Aug 1968. 4 fig, 16 ref.

Descriptors: *Demand, *Income, Profit, Utility, Marginal utility, Marginal cost, Prices, Taxes, Government, Industrial production, Equilibrium.
Identifiers: *Sales, Market, Sales-maximization, Income effect, Substitution effect.

The position of quasi-public firms in the water resources area is such that this paper should prove useful to the water resource planner. This study considers the demand for inputs of a firm which maximizes sales subject to a profit constraint, under perfect competition in input markets and imperfect competition in the output market. The author seeks to determine how such a firm would vary its input mix as input prices and output vary through the use of a detailed comparative-statics analysis. Equilibrium conditions, yielding input demand functions, are derived. The Slutsky equation is used to study the effects of changes in input prices and to observe the explicit income and substitution effects. The phenomena of Giffen inputs are discussed and comparisons made. Finally, it is shown that if there is no regression, the sales-maximizers price-elasticity of demand for any input will be greater than that of the profit-maximizer. (Murphy-Rutgers)
W69-08985

ECONOMIC MEASURES IN THE RATIONAL UTILIZATION OF WATER RESOURCES,
M. Loiter.
Problems of Economics, Vol 11, No 3, p 33-44, Jul 1968. 12 p, 6 tab.

Descriptors: *Natural resources, *Water utilization, Water pollution, Economics, Water shortage, Water supply, Prices, Costs, Consumptive use.
Identifiers: *Economic measures, Economic reform, USSR, Quality.

The entire course of the USSR economic reforms presently being carried out poses the problem of increasing the effectiveness of utilization of the richest natural resources that the country has at its disposal. A necessary prerequisite of all measures and, in particular, of those aimed at the solution of this problem is the economic evaluation of natural resources being used at the present time and those which will be brought into economic circulation in the near future. Under these conditions, the search for and development of a methodological basis for the economic evaluation of natural resources is a natural phenomenon. Such a basis must be uniform for various types of natural resources and must by a kind of yardstick for concrete methods and ways of making economic assessments of them at the same time taking into account the specific features of the use of alternative natural resources. The author discusses the problem of water shortages in several regions of the USSR and the basic principles in the establishment of payments for the use of water resources. This later discussion, along with the general resource analysis of the paper may be of relevancy to water conservation and planning studies in this country. (Loeb-Rutgers)
W69-08987

SOME PROBLEMS OF CRITERIA AND ACQUIRING INFORMATION,
California Univ., Los Angeles, Calif.
Roland N. McKean.
IN Environmental Quality in a Growing Economy, Baltimore, The Johns Hopkins Press, 1966. p 61-65, 5 p, 1 ref. Henry Jarrett, Editor.

Descriptors: *Government, *Pollution, *Optimization, *Economic efficiency, Effluents, Erosion, Pollution, Taxes, Fish stocking, Subsurface water, Fisheries, Water supplies, Costs, Smog, Value, Input-output analysis.
Identifiers: *Externalities, *Public sector, *Private sector, Goods, Services, Steel, Marginal value, Noise abatement, Gains.

This article begins with the idea that action concerning an externality is appropriate only if gains promise to exceed costs, whatever value system is being used as criteria. Not to abolish an external cost would not, then, necessarily indicate a deviation from attainable optimality. As far as the decisions about actions to be taken by government are concerned, the author points out that judgments about many items may properly enter, since there is no fundamentally correct criterion in group decision making. Because of equity considerations, various efficiency boundaries in such decisions may be disputed, yielding legitimate disagreements about the nature of these boundaries and the prices to be attached to various goods and services. In considering gains/costs relationships, the cost of acquiring the relevant information should be considered, along with the cost of internalizing the externality. Both these processes can be so expensive as to be uneconomical and far from an improvement of the situation at hand, whether it be a question of noise reduction of pollution abatement. In both the public and private sector, the rights of certain individuals to resources and services are ill-defined, and decision-makers are restricted to 'groping in the dark.' Water resource analysts can use this article as a guideline for assisting their own decision-making process. (Murphy-Rutgers)
W69-08990

THE EFFECTS OF LOW-COST HYDRO POWER ON INDUSTRIAL LOCATION,
Manitoba Univ., Winnipeg.
Gunter Scramm.
Canadian Journal of Economics, II, No 2, p 210-229, May 1969. 20 p, 2 fig, 6 tab.

Descriptors: *Hydroelectric power, *Costs, Tennessee Valley Authority Project, Electricity, Industrial production, Magnesium, Aluminum, Technology.
Identifiers: *Hydropower, *Industrial location, Bonneville Power Administration, Canada, Power-intensive industries, Chemical pulp, Titanium sponge, Atomic power.

Past experience shows that the availability of low-cost hydro power can significantly affect the locational decisions of power-intensive industries. In the United States the developments of the Tennessee Valley Authority in the Southeast and the Bonneville Power Administration in the Northwest have led to large-scale settlements of such industries in areas which, with the exception of low-cost energy, generally offered neither suitable local raw materials sources nor nearby markets. Similar developments took place elsewhere. A main reason for Canada's and Norway's large export oriented electro-metallurgical and chemical industries are favorable hydro power sources in close vicinity to tidewater locations. The author examines whether the underlying cost-price relationships of these locational decisions are still valid for the present and the foreseeable future. This is a question of considerable interest to Canada because it is one of the few industrialized nations that still has substantial sources of undeveloped hydro power available. It is of great interest also to the undeveloped countries that are rich in hydro resources but unable to utilize them unless substantial industrial energy loads are developed at the same time. (Loeb-Rutgers)
W69-08991

NEW TASKS FOR ALL LEVELS OF GOVERNMENT,
Brandeis Univ., Waltham, Mass.
Norton E. Long, and Henry Jarrett.
Environmental Quality in a Growing Economy, Baltimore, The Johns Hopkins Press, 1966, p 141-155. 15 p.

Descriptors: *Governments, *Statistics, *Urban renewal, Air pollution, Water pollution, Value, Pesticides, Sewage, Income, Taxes, Watersheds, Waste disposal, Investment.
Identifiers: *Environmental quality, *National policy, *Laissez-faire, Tax surplus, Free market, Budget, Housing.

The article discusses the need for indicators of environmental quality to be built into the national public reporting system at the Presidential level since the Federal Government has the greatest freedom from fiscal constraint in its initiatives. The factor of political expediency is suggested to be a mainspring of the technology through which things get done about air and water pollution, pesticides, urban transport, flights, floods, and the like. The contenders for a share in Federal political expediency actions in the area of environmental control are primarily the Housing and Urban Development Department, and the Departments of Health, Education and Welfare, Commerce, The Interior, Agriculture, and Labor. Action at the Federal level can result in regionalized areas and staffs which act as the arm for Presidential field coordination, thus permitting regional problems to be dealt with most effectively, whether of a metropolitan, a watershed, or a drainage difficulty. Another possibility would be internalizing the costs of some problems, such as controlling pollution, to industry, with Federal supervision. Improving the quality of the environment can be achieved part-way by the leadership and fiscal aid of Washington, and complemented by metropolitan and/or regional government action. (Murphy-Rutgers)
W69-08993

A REINTERPRETATION OF THE PURE THEORY OF EXHAUSTION,
Pennsylvania State Univ., University Park.
Richard L. Gordon.
Jour Pol Econ, Vol 75, No 3, p 274-286, June 1967. 13 p, 12 ref, 1 append.

Descriptors: *Natural resources, *Profit, Competition, Costs, Prices, Conservation, Technology, Monopoly, Equilibrium, Constraints, Interest rate.
Identifiers: *Exhaustion, *Increasing costs, Social costs, Maximization, Present value, Uncertainty, Reserves, General industry model, Output, User costs.

Eventual exhaustion of natural resources is often regarded as a serious economic problem, but the theory of the subject remains somewhat inadequate. A more comprehensive model generalizing prior analyses and re-evaluating the empirical implications of the theory is needed. Extensions are also required to analyze the vital distinction between optimal centralized management and the collective behavior of separate firms in a competitive industry. The literature is reviewed and a theoretical model developed which incorporates most prior analyses as special cases. At this stage it is assumed that only current output affects profits. Later the more general case in which past production also influences current profits is considered. The difficulties in developing a general industry model are also discussed. This section neglects the complication produced by the effects of past production on profits, and relates existing models to industry analysis. A model using linear cost and demand functions to show that efficient social decision making can produce different results from private, competitive behavior is developed in the appendix. Much of what is derived here for any natural resource could be applied to problems in water resources management. (Sokoloff-Rutgers)
W69-08997

CONCERNING EVALUATION OF NATURAL RESOURCES,
lu Sukhotin.
Problems of Economics, Vol XI, No 2, p 29-39, June 1968. 11 p, 1 tab.

Descriptors: *Natural resources, Water resources, Water pollution, Productivity, Profit, Legal aspects, Administrative decisions, Value, Rent, Industrial wastes, Compensation, Linear programming.
Identifiers: *Economic evaluation, *Complete cost accounting, *Accounting price, *USSR, Socially necessary expenditures.

One of the most complex problems is the economic evaluation and organization of cost accounting relations with respect to water resources since joint use is made of them. The use of water can be on a returnable basis (for example, electric power stations) and also on a non-returnable basis. The largest consumer of water on a non-returnable basis at the present time is agriculture. If non-returnable consumption by any user of water does not reduce the water supply of the remaining users, a given source of water is not as yet a limited resource and does not have an economic evaluation. However, in many regions users of water must pay for non-returnable consumption according to the outlays required for replacement. If this consumption results in (for example) poorer navigation conditions, outlays for replacement take the form of additional outlays for shipping part of the goods by other means of transport. Pollution is one of the most serious factors in the increasing dimunition of water resource. As a result of pollution, various types of compensatory outlays must be made. The entire sum of these additional national economic costs must be fully compensated for by the enterprises contaminating the water. This article could be useful in a comparative study of the economic evaluation of water resources. (Sokoloff-Rutgers)
W69-08998

A UTILITY MEASURE BASED ON TIME PREFERENCE,
Dayton, Ohio.
Hermann Enzer.
Econ Jour, Vol LXXVIII, No 312, p 888-897, Dec 1968. 10 p, 7 ref.

Descriptors: *Cost-benefit analysis, Water supply, Public benefits, Probability.
Identifiers: *Public projects, *Ordinal utility function, *Time preference, Market prices, Subjective measures, Ordering, Public goods, Mathematical expectations.

In a recent survey Prest and Turvey discussed the applications of cost-benefit analysis to such public projects as water supply, transportation, health and education, and defense. Lack of emphasis on these areas is due to the fact that cost-benefit analysis when applied to these areas, is essentially only cost analysis. The author endeavors to seek a utility measure for the set of items that do not have market prices and for which none may be derived or imputed, such as in the case of water-supply projects. One cannot fall back on an ordinal utility measure and derive anything better than a ranking precisely because there are no market prices. The author believes that any attempt to improve upon the necessarily subjective measures that are usually applied might be worth the effort. A utility measure is suggested which, in certain circumstances may provide reasonable approximations to the relative utilities of a set of items that do not possess market prices. As in the case of other measures that have been constructed, such as the von Neumann-Morgenstern measure, or the Pareto-Lange approach of comparing utility differences, some of the assumptions made are questionable. The author believes that his approach is an improvement over some of the other utility measures which have been defined on orderings of items that may not have market prices. (Sokoloff-Rutgers)
W69-09001

THE MEASUREMENT OF UTILITY,
Case Western Reserve Univ., Cleveland, Ohio.
C. Hillinger.
Rev Econ Studies, Vol XXXVI (1), No 105, p 111-116, Jan 1969. 7 p, 4 ref.

Descriptors: *Marginal utility, *Elasticity of demand, Consumptive use.
Identifiers: *Utility maximization, *Income elasticities, *Intertemporal allocation, Relative prices, Econometric studies, Demand function, Luxury goods, Mean value theorem.

This paper shows how the utility levels attained by a consumer may be measured exactly under idealized conditions. These conditions include knowledge of the trajectories of prices, income, and quantities, and of the numerical magnitudes of certain elasticities. This approach provides a ranking for all consumption vectors on the trajectory. An analytical expression is given, showing the effects on the marginal utility of income of changes in income and in relative prices. These effects depend on the income elasticities of commodities and on the income elasticity of the marginal utility of income. This provides a link between a number of concepts and parameters in consumer theory. The result also lends itself to empirical application. Estimates of the demand elasticities are available from many econometric studies. The less well known elasticity of the marginal utility of income plays a role in intertemporal utility maximization. It is shown how this may be estimated following Samuelson, by using data on total consumption expenditures over time. The ability to derive a grand utility function would aid policymakers in the optimum allocation of resources. These decisions could include important water resources allocation problems. (Sokoloff-Rutgers)
W69-09003

COST-BENEFIT ANALYSIS: A SURVEY,
Manchester Univ. (England).
A. R. Prest, and R. Turvey.
The Economic Journal Vol 75, No 300, p 683-735, December 1965. 53 p, 2 fig, 90 ref.

Descriptors: *Project planning, *Cost-benefit analysis, Benefits, Welfare economics, Financing, Resources, Flood-control, Investment, Indirect benefits, Irrigation, Project life, Prices, Supply, Demand, Wages, Taxes, Government, Interest rate, Budgeting, Value, Roads, Recreation, Transportation.
Identifiers: *Hydroelectric power, Savings, Waterways.

Cost-benefit analysis, as a practical way of assessing the desirability of projects is of vital importance in the water resource area. In this article the authors provide a general survey of the entire area of benefit-cost analysis. The first section outlines the development and scope of this type of analysis. The second section deals with the general principles of benefit-cost study. The next section provides a survey of the applicability of the analysis to various fields. Included here is the discussion of its applicability to water resource projects with particular regard to flood control, irrigation and hydroelectric power. In the last section the area of benefit-cost analysis is reviewed within the preceding framework. The conclusion points out the difficulties of evaluation, especially on the benefit side of the analysis but notes the significant usefulness in the area of project evaluation. (Murphy-Rutgers)
W69-09005

BENEFIT-COST ANALYSIS AND PUBLIC RESOURCE DEVELOPMENT,
California Univ., Berkeley.
S. V. Ciriacy-Wantrup, S. C. Smith, and E. N. Castle.
Economics and Public Policy in Water Resource Development, Ames, Iowa, Iowa University Press, p 9-21, 1964. 13 p, 9 ref.

Descriptors: *Cost-benefit analysis, *Government, *Economic justification, Resource development, Direct benefits, Physical properties, Political aspects, Cost allocation, Market value, Recreation, Cost repayment, Employment, Costs, Taxes.
Identifiers: *Extramarket effects, *Intangibles, Quantification, Primary effects, Secondary effects.

The author states his belief that benefit-cost analysis, with its considerable expense, great effort and risk of misleading results is worthwhile despite the fact that governmental decisions regarding resource development are essentially political rather than economic. This type of analysis restrains the abuse of economic arguments in the political process. It also increases scientific understanding of the physical and social problems involved in resource development. Benefit-cost analysis can make use of extramarket benefits and costs through numerous indirect means. It also can be used in considering indirect as well as direct benefits and costs stemming from and induced by a public resource development project. It is superior to the use of willingness to pay as an economic criterion. The author states his belief that, in addition, there are potentiabilities for improvement that may render the practical influence of benefit-cost analysis considerably more potent. Since water resource studies have relied heavily on benefit-cost studies this article has relevance to water researcher. (Murphy-Rutgers)
W69-09006

CONSUMER ATTITUDES, BUYING INTENTIONS AND EXPENDITURES: AN ANALYSIS OF THE CANADIAN DATA,
Michigan Univ., Ann Arbor; and Bank of Canada, Ottawa (Ontario).
Harold T. Shapiro, and Gerald E. Angevine.
The Canadian Journal of Economics, II, No 2, p 230-249, May 1969. 20 p, 3 fig, 8 tab, 2 append.

Descriptors: *Expenditures, Income, Attitudes, Forecasting.
Identifiers: *Consumer attitudes, *Buying intentions, Index of Consumer Sentiment, Index of Consumer Mood, Automobile expenditures, Durable good expenditures, Services.

In the simplest Keynesian consumption function, income acts as a proxy for both the ability to buy and a complex of attitudinal and expectational variables of households concerning jobs, employment, and business conditions in the months and years ahead. In general, however, variations in consumer attitudes will not be solely dependent upon current levels and recent changes in income but also upon a wide range of other factors which are subject to independent variation. If these various factors could be measured and summarized to form a single variable (A) that would represent the current buying attitude of the entire consumer sector, such a measure might significantly improve our ability to forecast short-run variations in consumer expenditures. The purpose of this study is to analyze the usefulness of a measure of consumer attitude, the Index of Consumer Mood, in forecasting consumer expenditures in Canada. Section I describes the construction of such an index. Section II tests the usefulness of this index in predicting. Sections III and IV employ various time series tests to compare the relative power of the attitude index, buying intentions data and fluctuations in stock prices in forecasting consumers' expenditures. Such an attitude variable may prove to be significant in forecasting both domestic and industry consumption of water in water demand studies. (Loeb-Rutgers)
W69-09007

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

MUNICIPAL WATER SUPPLY FOR NONRESIDENTS: RECENT DEVELOPMENTS AND A SUGGESTION FOR THE FUTURE,
Colorado Univ., Boulder.
Joseph L. Sax.
Natural Resources Journal, Vol 5, No 1, May 1965. p 54-61, 29 ref.

Descriptors: *Municipal water, *Judicial decisions, Water rates, Water supply, Water costs, Discriminatory pricing.
Identifiers: *Suburban water.

Although there is a growing acceptance of the doctrine that a city should provide neighboring suburbs with water on reasonable and nondiscriminatory terms, courts continue to rule for the defendant cities. Nonresidents urge that a differential charge is per se unreasonable and therefore unlawful. Cities introduce evidence which might justify differential rates. There are valid claims, such as cases where city taxes finance the water system, and cases where outside areas are sparsely settled and thus have higher costs of maintenance and service. There are also claims which win cases but do not compensate for inflated suburban water rates. It is concluded that plaintiffs must cease limiting themselves to the discrimination per se argument and must force a specific analysis of the rate differential at issue. A workable solution may be to impose upon defendant cities a duty of compiling and producing the cost data for each item which is utilized in determining rates. Such a rule does not shift the traditional burden of proof; it merely particularizes the burden of production. Also, the city should have this information at hand, if its rate records are in order. (Gossen-Chicago)
W69-08630

POLLUTION CHARGES, WASTE ASSIMILATIVE CAPACITY INVESTMENT, AND WATER QUALITY: THE PUBLIC COSTS OF A PUBLIC GOOD,
Ohio State Univ., Columbus. Dept. of Economics.
J. Hayden Boyd.
OWRR Project No A-010-OHIO. Work supported by funds from OWRR, Dept of Interior. Ohio State Univ Water Resources Center Rep, Jan 1969. 89 p, 2 fig, 5 tab, append.

Descriptors: *Water pollution control, *Optimization, *Systems analysis, Economics, Costs, Low-flow augmentation, Reaeration, Oxygen demand, Taxes, Cost analysis.
Identifiers: Pollution abatement costs.

A systems analysis study was made of the relationship between pollution-charge tax income and the costs of augmentation of waste assimilative capacity, with both set to maximize benefits to rivers. Parametric cost functions for several waste treatment technologies are derived. It is concluded that low-flow augmentation coupled with optimal-level pollution changes will probably generate substantial financial surpluses, while artificial aeration will probably break even or generate a small deficit. (Knapp-USGS)
W69-08751

METHODS FOR CALCULATING THE COST OF DEVELOPING GROUND-WATER RESOURCES IN APPALACHIA,
Geological Survey, Charleston, W.Va.
For primary bibliographic entry see Field 02F.
W69-08764

COMPARATIVE COST EVALUATION OF DESALTED WATER SUPPLY VERSUS ALTERNATIVE FRESH WATER SUPPLY FROM A CONVENTIONAL SOURCE,
Texas Water Development Board, Austin.
For primary bibliographic entry see Field 03A.
W69-08868

COST OF PUMPING IRRIGATION WATER IN TEN NEW MEXICO COUNTIES,
New Mexico State Univ., University Park. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 03F.
W69-08963

NATURAL-GAS-PIPELINE RATE REGULATION: MARGINAL-COST PRICING AND THE ZONE-ALLOCATION PROBLEM,
Laurence C. Rosenberg.
Jour Pol Econ, Vol 75, No 2, p 159-168, Apr 1967. 10 p, 3 fig, 4 tab, 9 ref.

Descriptors: *Utilities, Natural gas, Peak loads, Consumptive use, Variable costs.
Identifiers: *Regulatory policy, *Federal Power Commission, *Zone-cost-allocation method, optimal rate structure, Atlantic Seaboard formula, Capacity costs.

Criticism of regulatory policy of gas and electric utilities is often based on a finding that rate-making procedures tend to cause prices to deviate from marginal costs such that peak-period users pay too little and off-peak users pay too much. Federal Power Commission (FPC) regulation of natural-gas pipelines may also result in a similarly defective rate structure, the result of which may be to inhibit utilization of existing plant and to construct too much capacity. The two necessary conditions to make such a criticism have not been adequately established, that is, what is an optimal rate structure and how do current practices deviate from it. For a sufficient analysis, peak-and off-peak period pricing must be considered along with the zone-cost-allocation problems that arise from the fact that pipeline customers are located at varying distances from the source of gas and are charged according to the zone to which they are assigned. This article extends the theory of peak-responsibility pricing based on marginal costs to include zone allocation and to evaluate FPC policy for its consistency with the results of the theoretical analysis. Both the peak-load pricing and zone allocation aspects of this article would have relevance for water pricing policy in certain locations. (Sokoloff-Rutgers)
W69-08983

SIDE EFFECTS OF RESOURCE USE,
Electricity Council, London (England).
Ralph Turvey.
IN Environmental Quality in a Growing Economy, Baltimore, The Johns Hopkins Press, 1966. p 47-60, 14 p, 12 ref. Henry Jarrett, Editor.

Descriptors: *Economic justification, *Resource allocation, *Pollution, *Economics, *Technology, Taxes, Fisheries, Fish stocking, Subsurface water, Water supply, Prices, Costs, Land, Wells, Rivers, Sewage, Marketing, Roads, Powerline carriers.
Identifiers: *External diseconomies, *Regulation, *Calculations, Water reserves, Criterion, Temperature, Brickworks, Noise.

The article is concerned with a consideration of the neglected side effects of the use of natural resources on the quality of the environment. These side effects, or external economies and diseconomies, are relationships in the market other than those between buyer and seller. To illustrate this concept, seven examples are used which give both reciprocal and/or unidirectional impacts. These examples are fisheries, traffic flow, wells, jet noise, river pollution, visual aesthet ics and cattle poisoning. Where side effects are involved, as in these cases, the market mechanism alone may not produce the best possible allocation of resources. Reduction of the adverse consequences of external effects is a multi-dimensional problem: who should do what and how much. To answer this, the economic criterion used should be that the present value of the monetary measure of all gains from modifying activities less the present value of the monetary measure of all losses from these modifications be maximized. Regulation is another possible solution, as is a tax. At any rate, each case must be individually weighed, alternatives should be considered, and it should be remembered that questions of fairness require legal or political decisions. (Murphy-Rutgers)
W69-08989

THE SOCIAL TIME PREFERENCE DISCOUNT RATE IN COST-BENEFIT ANALYSIS,
Nuffield Coll., Oxford (England).
M. S. Feldstein.
The Economic Journal, Vol 74, No 294, p 360-379, Jun 1964. 20 p, 16 ref.

Descriptors: *Cost-benefit analysis, *Costs, Interest rate, Discount rate, Capital, Income, Demand, Government, Consumption, Fixed costs, Economics, Rates.
Identifiers: *Social time preference, *S T P rate, Capital market, Rate of return, Opportunity costs.

In this paper the author finds that the social time preference function cannot be derived on the basis of existing market rates, but must be administratively determined as a matter of public policy. As a subtopic in the area of benefit-cost analysis this article, with its concentration on the problems of public goods, is of particular interest to the water resource planner. The article examines the characteristics of the social time preference (S.T.P.) function, its relation to the S.T.P. rate and the movement of the S.T.P. rate through time. The article concludes with several recommendations for more effective decisions in the public investment area. (Murphy-Rutgers)
W69-08992

ECONOMIC EVALUATION OF WATER, PART IV AN INPUT-OUTPUT AND LINEAR PROGRAMMING ANALYSIS OF CALIFORNIA WATER REQUIREMENTS,
California Univ., Berkeley.
E. M. Lofting, and P. H. McGauhey.
Water Resources Center Contrib, No 116. August 1968. WRC Project W112-1B-65/69. OWRR No B-017-Cal. 187 p.

Descriptors: *California, *W ater resources development, *Water demand, *Input-output analysis, *Linear programming, *Resource allocation, Cost-benefit analysis, Economic feasibility, Financial feasibility, Taxes, River basin development, Leontief models, Dynamics, Regional analysis, Capital, Constraints, Discount rate, Export, Water utilization, Fresh water.

Identifiers: *Public investment programs, *General equilibrium analysis, Empirical data, Final demand, Sector, Interindustry transactions, Dual problem.

In scope this study considers both the methodology and the limitations of the linear programming model as a planning and decision-making goal. An interindustry model for the State of California is constructed based on national and secondary data sources for the year 1958. The model is aggregated to a representative number of sectors for which water-use data could be obtained and formulated as a linear programming model for which typical fresh water withdrawal constraints could be changed parametrically. A time series for Gross State Product was developed for 1940 to 1966 in 1958 constant dollars and growth projections were made to the year 1990. Ranges of final demands for the model were set and solutions obtained so as to maximize Value Added given different levels of fresh water availability. Minimal levels of water required were determined and estimates made that would satisfy the specified demands fully. The dual solutions of the linear program were noted as the water constraints were changed and the shadow prices for water were determined for different levels of water availability. (Sokoloff-Rutgers)
W69-08994

ROAD PRICING,
London School of Economics and Political Science (England).
A. A. Walters.
De Economist, Vol 116, No 5, p 545-60, Sept/Oct, 1968. 17 p, 1 tab.

Descriptors: *Pricing, Gasoline, Taxes, Capital costs, Financing, Rent, Queuing theory, Urbanization.
Identifiers: *User charges, *Congestion costs, *Social costs, Market forces, Scarcity, Traffic level, Road space, Subsidies, Public transport.

Among the main problems in the public sector of the economy are those of road congestion on the one hand and under-utilization of roads on the other. This is partly a consequence of inefficient price policies for the use of roads. But road pricing involves many technical and distributional problems. A preliminary survey of the effects suggests that quite simple road pricing systems, such as a differentiated urban-rural license fee, may be a most efficient way of introducing road pricing. Tolls on critical access points may be another efficient way of introducing congestion charges. At the same time it is important to attempt to reduce charges on uncongested roads, and this is especially necessary for developing countries. A preliminary survey of the effects of such a rearrangement of road taxation suggests that there would be no market redistributional effects. But much more work is required on this aspect of road pricing. This analysis has some application to pricing and taxation policy for water resources, especially in cases where there are many competing demands on an inadequate fixed supply, that is not easily augmentable. (Sokoloff-Rutgers)
W69-08995

COST AND REVENUE ASSOCIATED WITH INCREASED SALES OF TVA POWER,
Missouri Univ., Columbia.
Richard L. Wallace.
Southern Econ Jour, Vol XXXIII, No 4, p 526-534, April 1967. 9 p, 5 tab.

Descriptors: *Tennessee Valley Authority Project, *Power marketing, Peak loads, Transmission (Electric), Alternative costs, Pricing, Economies of scale, Economic efficiency, Resource allocation, Investment, Interest rate.
Identifiers: *Capacity costs, *Energy costs, Social cost, Wholesale rate structure, Asset life, Stream plants, Production costs, Annual load growth, Revenue.

The purpose of this paper is to determine whether TVA's wholesale rates are consistent with the goal of efficient resource allocation. Since this goal requires prices that reflect the social cost of supplying additional power, the costs of providing for annual load growth, as it has occurred under TVA's rate structure, are compared to the increases in revenue for which the additional power is supplied. Cost and revenue estimates are compared for overall annual increases in TVA load and for annual increases in the loads of each of the three classes of TVA customers (municipal and cooperative distributors, 36 large industrial firms served directly by TVA, and other federal agencies). In addition, the cost imposed on TVA when a new all-electric home is added to a distributor's lines is compared to the increase in revenue received by TVA from the distributor for power resold to this customer. This comparison is made because of the important contribution of electric heat to the system peak. This article may have some applicability in deciding pricing policies for water resources. (Sokoloff-Rutgers)
W69-08996

TRANSACTION COSTS, RESOURCE ALLOCATION AND LIABILITY RULES--A COMMENT,
Yale Univ., New Haven, Conn.
For primary bibliographic entry see Field 06E.
W69-09000

SOME POLITICAL ASPECTS OF LARGE SCALE INTER-BASIN TRANSFERS,
Wisconsin Univ., Madison.
I. K. Fox.
Presented at the Annual Meeting of the American Association for the Advancement of Science, Dallas, Texas, December 30, 1968. 22 p.

Descriptors: *Inter-basin transfer, Negotiation, Cost allocation, Economics, Water resources development.
Identifiers: Political processes, Public policy, Bargaining, National interest.

This paper characterizes the political processes through which inter-basin transfer decisions are made and identifies some of the basic public policy issues in this area. The political process involves negotiation and bargaining among groups--some with interests primarily in the region of water origin, some with interests primarily in the region receiving the supply, some with a major interest in development programs, and some with a national interest. These groups adopt strategies and make demands in accord with their respective interests. In view of the high cost of water transfers, public action requires a strategy which achieves an acceptable distribution of costs and returns among the bargaining groups, a unified effort on the part of those who will benefit, and avoiding behavior and plans that will needlessly arouse opposition. Three major policy issues are identified: (1) Will realistic alternatives for meeting demands for water and water services be examined in the bargaining process; (2) Will all groups affected by a proposed transfer be represented in the decision with regard to a proposed transfer; (3) How will the costs of the transfer be shared. (Author)
W69-09025

6D. Water Demand

SOME ASPECTS OF WATER SUPPLY AND SEWERAGE IN ROMANIA (ROMANIAN),
State Water Committee, Bucharest (Rumania).
For primary bibliographic entry see Field 05D.
W69-08962

STATISTICAL APPENDIX,
Nevada Univ., Reno. Div. of Agricultural Economics and Education; and Nevada Univ., Reno. Max C. Fleischmann Coll. of Agriculture.
For primary bibliographic entry see Field 04C.
W69-08964

THE DEMAND FOR RECREATION IN OKLAHOMA,
Oklahoma State Univ., Stillwater. Dept. of Agricultural Economics.
John G. McNeely, Jr.
First annual Oklahoma Outdoor Recreation Conference Proceedings, p 1-9, Mar 9 and 10, 1967. 9 p, 1 fig, 1 map, 3 tab.

Descriptors: *Recreation demand.
Identifiers: *Oklahoma.

Outdoor recreation is no longer a free good of nature, but has a price due to an ever increasing demand for it. Some of numerous factors that have played a role in increasing the demand for recreation are rising incomes, increased leisure time, increasing population, and better roads and highways. Projections of national population, GNP, per capita disposable income, average work week, average paid vacations, and miles travelled per capita are given. Then projections of the demand for recreation in Oklahoma are made. Some ways in which the increasing demand may be met are discussed. (Grossman-Rutgers)
W69-08965

ECONOMIC IMPACT OF RECREATIONAL DEVELOPMENTS IN THE RESERVE RANGER DISTRICT,
New Mexico State Univ., University Park. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 04C.
W69-08967

ECONOMIC DEVELOPMENT THROUGH PLEASURE AND PROFIT,
Oklahoma State Univ., Stillwater. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 04C.
W69-08971

THE WATER CRISIS IS PRESENT,
Development and Resources Corp., Sacramento, Calif.
William E. Warne.
Natural Resources Journal, Vol 9, No 1, p 53-62, Jan 1969. 10 p.

Descriptors: Irrigation, California, Colorado River Basin, Water quality, Surface waters, Storage, Pollutants, Inter-basin transfers, Low-flow augmentation.
Identifiers: *Water crisis, *Clean Water Act, *Quality-quantity conflict, Water diversion, State Water Resources Control Board, Mineral content.

The water crisis is present in California, it is in the Colorado River Basin, and it is found in most of the river basins across the nation. The federal government took action that revealed the presence of the water crisis. Namely, under the Clean Water Act, it required the states to establish quality standards on interstate streams. In California, the former State Water Pollution Control Board wrestled for several years with the problem of fixing statewide criteria for water pollution control, but it could not bring about much agreement and its action was inadequate. When the Board considered the standards it would adopt for the Delta, the Dept of Water Resources successfully contended that the adoption of too high a standard for the control of salinity, would tend to disrupt water projects already adopted. Acceptable water quality, measured by salinity, cannot be maintained in the Delta without conflict with surface water storage and diversion projects of utmost importance to the state. It is the subtle changes wrought by use and reuse of limited water supplies that is the problem in California, changes that are measured in laboratories in the mineral content of the rer ing water. (Sokoloff-Rutgers)
W69-08973

EXTERNAL DISECONOMIES, CORRECTIVE TAXES, AND MARKET STRUCTURE,
California Univ., Los Angeles.
James M. Buchanan.
Amer Econ Rev, Vol LIX, No 1, p 174-177, Mar 1969. 4 p, 1 fig, 5 ref.

Descriptors: *Welfare, *Water pollution control.
Identifiers: *Externalities, *Corrective taxes, *Competitive structures, *Theory of second-best, Pigovian policy norms, Pareto efficiency, Production function.

Orthodox Pigovian analysis suggests the levy of taxes in situations of external diseconomies. Economists have recently demonstrated some of the limitations on this device. They have not pointed out one elementary requirement: the levy of a corrective tax may reduce efficiency in non-competitive market structures. This point is developed geometrically, and provides a singularly clear example of the principle of second-best situations. Since external diseconomies are frequently found in analyzing water resource requirements this article has relevance to water pricing and allocation studies. (Sokoloff-Rutgers)
W69-08978

COMPETITIVE EQUILIBRIUM: EXISTENCE AND APPROACH,
New School for Social Research, New York.
Hans Neisser.
Jour Pol Econ, Vol 76, No 6, p 1199-1208, Nov/Dec 1968. 10 p, 18 ref.

Descriptors: *Mathematical models, Capital, Interest rate.
Identifiers: *Competitive equilibrium, *Long-run equilibrium, Natural prices, Inputs, Productive services, Equilibrium path, Converging series, Technical progress.

An analysis of Walras shows that long-run equilibrium in his sense can only be attained in very special situations, if at all. As to Alfred Marshall, an unfortunate preoccupation with marginal relations excluded the mathematical closing of his system. However, he did suggest what is commonly called a dynamic relation, the inter-temporal price relation, which has proven to be worthwhile investigating. With this in mind the author disaggregates the Keynesian model as far as possible and then introduces the inter-temporal relation, obtaining a model which he believes is more realistic than Walras', and yet one which leads as far (except for wage determination) as the Laussane model. In principle its dynamic component would allow one to find out whether it converges and, if so, to describe the long-run equilibrium toward which it gravitates. Stationary price expectations make this dynamic system dependent on the values of parameters--the quantity of money, 'aggregate' prospective yield and the conventional interest rate, none of which is likely to remain the same. Yet this task should not be attempted since it is known that because of technical progress the western economy diverges at a rate between 3-4.5 percent per year. Macro-equilibrium behavior is a condition that is assumed in many projections of demand for water resources. The validity of this assumption should affect the validity of these projections. (Sokoloff-Rutgers)
W69-08999

WATER USE IN SOUTH FLORIDA RESIDENCES--A SOCIOLOGICAL PERSPECTIVE,
Florida Univ., Gainesville.
Daniel Kubat, Lillian Lei, and George Watkins.
Project Completion Report, OWRR Project A-010 FLA, 1968. 180 p, 8 fig, 47 tab, 97 ref, 3 append.

Descriptors: *Florida, *Water supply, *Domestic water, *Water requirements, *Correlation analysis, Population, Organization, Water users.
Identifiers: *Sociological research, *Residential water, *Scale of attitudes, *Community action, *Questionnaires, *Mean water use curve, *Demographic characteristics.

This nation required only 40 billion gallons of water daily in 1900, but by 1965 it required 360 billion gallons a day, an increase of more than threefold in the use per capita. As the standard of living increases it is expected that the strains on the adequate and high-quality water supply will increase. Literature on community action can be combined with those few studies which pertain to watershed acceptance patterns among populations concerned, in order to supply the basis for social science analysis. Such a combination may provide enough data to suggest some policy recommendations regarding water resource conservation for specific communities. The purpose of this study is to determine what relationships there are between water consumption in residential areas, as compared with certain designated demographic and social characteristics of the population. The study aims at discovering some set of basic attitudes to water consumption, conservation and waste with the goal of unraveling the underlying values about water as a commodity. (Sokoloff-Rutgers)
W69-09002

GROUNDWATER--A NEGLECTED RESOURCE,
Geraghty and Miller, Port Washington, N.Y.
James J. Geraghty.
Jour American Water Works Assoc, Vol 59, No 7, p 820-828, July 1967. 9 p, 5 fig, 1 ref.

Descriptors: *Groundwater, *Geologic formations, Coastal plains, Pumping, Natural recharge, Salinity.
Identifiers: *Natural reservoirs, Freshwater reserves, Utilization, Temperature variations, Wastes contamination.

When the Pilgrims first landed on these shores, this nation's natural underground tank held an estimated 47 bil acre-ft of ground water. As of 1955, we had used up only 0.2 percent of this immense quantity. At the present rate of depletion the quantity of ground water known to be present in our aquifers would last for another 7,800 years. To make an estimation of the availability of groundwater for a particular region is a difficult matter, because this resource is completely hidden from view. The only way to determine how much groundwater can be pumped in a given region is to undertake careful studies of the geology, the natural rate of replenishment from rainfall, the ability of the formations to transmit water to wells, and similar factors. Often, such investigations call for test drilling and the carrying out of geo-physical surveys. Probing the earth in this way can be expensive, but there are no shortcuts, and as groundwater is one of our vitally important resources, the results are almost always well worth the investment. (Sokoloff-Rutgers)
W69-09004

6E. Water Law and Institutions

MAYNARD V HAWLEY (SUIT TO ENJOIN DRAINAGE OF WATER UPON LAND).
For primary bibliographic entry see Field 04A.
W69-08634

POLICIES FOR WATER LAW: PROPERTY RIGHTS, ECONOMIC FORCES, AND PUBLIC REGULATION,
Wyoming Univ., Laramie.
Frank J. Trealease.
Natural Resources Journal, Vol 5, No 1, May 1965. p 1-48, 141 ref.

Descriptors: *Legislation, Optimization, Economics, *Public rights, Cost-benefit analysis, Water utilization, Intangible benefits, Intangible costs, *Water rights, Regulation, Appropriation.
Identifiers: *Legislative policies, Property rights.

The paper analyzes the policies that lie behind water laws. Section I discusses the ultimate goal for water resource law - maximization of benefits. The suggested means for achieving this goal are property rights, economic forces, and public regulation. Section II describes a system in which property rights could maximize benefits, and discusses the acquisition of rights, the difference between public and private cost-benefit analyses, intangible costs - and benefits, duration of the water right, and the need for clear description of the right. Section III discusses economic forces. It considers changes over time in uses of water and changes from private to public use. Section IV, on public regulation, prevention of cost - shifting, and devices for protecting public interests. Present water law has many shortcomings. Many aspects of western water law prohibit optimal use of water. Maximum development is impeded by both western and eastern laws restricting the place of use. There are paper rights representing unused appropriations which may upset valuable existing uses. Some western laws tie water to land and prevent its movement on the market to higher uses. (Gossen-Chicago)
W69-08635

UNITED STATES GYPSUM CO V MYSTIC RIVER BRIDGE AUTH (ACCESS TO DOCKS BY WATER).

106 NE 2d 677-684 (Mass 1952).

Descriptors: *Docks, *Navigable waters, *Bridges, *Massachusetts, Eminent domain, Condemnation, State governments, Rivers, Riparian rights, Damages, Remedies, Judicial decisions, Bridges, Compensation, Bridge construction, Piers, Legal aspects.

Petitioner manufactured plaster board in a plant bordering a navigable river. Raw materials were transported by water to petitioner's plant. The respondant, Mystic River Bridge Authority, was created by statute to build a bridge for vehicular traffic. The authority was authorized to locate the bridge, acquire land and easements, and contract for erection of the bridge. In erecting the bridge, a pier was placed in the bed of the river approximately eighty feet offshore of the petitioner's wharves. This pier severely hampered petitioner's operations and decreased the value of his land. In a proceeding on the petition for assessment of damages, the jury awarded $262,950. On appeal, the court held that when an owner of a wharf on land bordering an arm of the sea has navigation between his property and the sea destroyed by the authorized construction of a bridge, neither the Constitution nor the common law required compensation. However, the legislature could choose to extend compensation to individuals who might suffer serious damage and who otherwise would receive no compensation. The legislature had authorized such compensation in the bill authorizing the bridge. (Gabrielson-Fla)
W69-08636

COMPREHENSIVE STATE PLANNING AS A FRAMEWORK FOR WATER RESOURCE DEVELOPMENT,
Arthur Ortiz.
In Thirteenth Annual Water Conference, Water for New Mexico to the Year 2000 and 2060, March 1968. p 48-58, 8 ref.

Descriptors: *New Mexico, *State jurisdiction, *Water resources development, Research and development, Area redevelopment, Long-term planning, Short-term planning.
Identifiers: *Planning districts, Rural-urban conflicts, Comprehensive planning.

The major function of the State Planning Office of New Mexico has been the development of a Statewide Resources Development Plan. Its first phase consisted of an inventory of the various resources of the state, with the resultant publication of approximately 40 studies. Resource availabi lity, development and related problems were analyzed, includi ng state water resources, water law and agricultural land and water. The second phase and current one consists of three aspects: (1) developing new techniques for handling emerging problems; (2) formulation of a Statement of Goals

and objectives to guide the state's overall comprehensive development; (3) provide direction to the programs of state agencies in terms of goals and objectives. The State Planning Office programs can be viewed most usefully as part of a planning process. The state has been divided into districts for planning and development purposes. Cultural patterns and major economic activities vary widely throughout the state and present opportunities and problems which are unique to particular regions. Each district may establish a regional planning commission, as permitted by New Mexico statutes. In terms of water resources development in the near future, the direction taken by the state's economy will be a critical factor. Improvements in the performance of state government should also promote effective water development policies. Finally, the creation of these planning and development districts also should yield benefits with respect to water development policies. As problems are resolved cooperatively on an area-wide basis, it is anticipated that conflicts between rural and urban interests over water utilization will lessen. (Starr-Chicago)
W69-08638

DITCHES AND DRAINS.

Minn Stat Ann secs 106.491 to 106.581 (1964).

Descriptors: *Minnesota, *Drains, *Ditches, *Drainage systems, Drainage engineering, Local governments, Drainage programs, Flood control, Sewers, Culverts, Bridges, Conduits, Outlets, Laterals, Pipes, Sewage disposal, Tiles, Obstruction to flow, Administrative agencies, Interstate, Legislation, Legal aspects, Cities.

If any ditch is obstructed by a bridge or culvert with an insufficient waterway opening to allow proper flow, the party responsible for such obstruction shall be required to remove it. Any improvement to a drain by tiling, enlarging or extending shall be preceded by a petition from affected property owners and a ruling by the county board or court based on a report of an engineer that the improvement is necessary. Improvements herein include only extentions downstream to a more adequate outlet or enlarging the original ditch system. Where a drainage system is likely to cause overflow of an existing drain, affected property owners may petition for improvement of the drain to eliminate the overflow. Persons owning land near an existing drainage system may petition for a lateral connecting the lands to the system. No private ditch may empty into a ditch authorized herein without permission of the county. The county or court ordering improvement of a drain may join with any adjoining state in the improvement if necessary. Any city desiring to use a public drainage system for a sewer outlet may petition the county controlling the drain. The petition shell have the approval of the state water pollution control commission. (Helwig-Fla)
W69-08738

MAINOR V HOBBIE (SUIT TO ENJOIN INTERFERENCE WITH FREE ACCESS RIGHTS TO BAY).
218 So 2d 203-206 (1st DCA Fla 1969).

Descriptors: *Florida, *Access routes, *Public rights, *Right-of-way, Recreation, Parks, Recreation facilities, Swimming, Bays, Legal aspects, Judicial decisions, Civil law, Real Property, Public rights.
Identifiers: Injunction.

This action was brought by subdivision property owners to enjoin other subdivision property owners from fencing in a portion of a street used for access to the bay and an irregular strip of land used as a recreation area. Plaintiffs based their access rights on a 1912 plat offering the contested area to the public for recreation and travel. Defendants claim that these access rights were cut off by a later suit to quiet title instituted by defendants' predecessors in title in 1951. The court, in finding for the plaintiffs, reasoned that a common-law dedication by the owner once accepted by the public was irrevocable by the owner or his successors in title except with the consent of the public and of those persons who had a vested right in the dedication. Looking at the 1951 suit to quiet title, the court ruled that since none of the plaintiffs herein were named or any public body having authority over streets were named, the quiet title suit did not cancel the alleged rights of the plaintiffs. (Logan-Fla)
W69-08741

OIL POLLUTION: PROBLEMS AND POLICIES,
For primary bibliographic entry see Field 05B.
W69-08752

SOME LEGAL AND ECONOMIC IMPLICATIONS OF SEA WATER INTRUSION--A CASE STUDY OF GROUND WATER MANAGEMENT,
California Univ., Davis. Dept. of Agricultural Economics; and California Univ., Davis. Water Resources Center.
For primary bibliographic entry see Field 02K.
W69-08768

WATER SALINITY PROBLEMS: APPROACHES TO LEGAL AND ENGINEERING SOLUTIONS,
Beardsley, Hufstedler and Kemble, Los Angeles, Calif.; and Colorado River Board of California, Los Angeles.
For primary bibliographic entry see Field 02K.
W69-08769

SUSQUEHANNA RIVER BASIN COMPACT; ORGANIZATION, POWERS AND DUTIES OF THE COMM'N.

Md Ann Code, art 96A:61, 62 (Supp 1968).

Descriptors: *Maryland, *Interstate compacts, *Interstate commissions, *River basins, Legislation, New York, Pennsylvania, Governments, State governments, Water policy, Water resources, Water resources development, Interstate rivers, River basin commissions, Water law, Rivers, Conservation, Water management, Basins, Diversion, Planning, Jurisdiction, Administrative agencies.
Identifiers: *Susquehanna River Basin Compact, Water allocation.

The Susquehanna River Basin Commission is created as an agency of the governments of the signatory parties to the compact. The commission's jurisdiction shall be within the limits of the basin. The general powers of the commission shall be to develop plans and projects relating to water resources and to promote policies for water resources conservation and management. It shall be the policy of the commission to use existing offices of government to effectuate the compact. The specific powers and duties of the commission relating to water resources conservation, development and management are set out. The commission and the signatory parties shall promote cooperation among the parties to the compact in effectuating its policies and purposes. The commission shall have the power to allocate water to and among the parties and to enter allocation agreements with other commissions or states. The commission shall have the power of review and approval of all non-exempt water projects within the basin. The commission shall approve any project not detrimental to the proper conservation, development or management of the basin's water resources. Any procedure for review and approval of water diversions shall be at public hearing, subject to judicial review. (Helwig-Fla)
W69-08772

NOSTDAL V WATONWAN COUNTY (DRAINAGE DISTRICT LIABILITY).

22 NW 2d 461-471 (Minn 1946).

Descriptors: *Minnesota, *Drainage district, *Bridges, *Assessments, Water law, Judicial decisions, Legal aspects, Ditches, Culverts, Remedies, State governments, Local governments, Costs, Civil law.
Identifiers: *Negligence.

Plaintiff brought this suit to compel defendant to remove an inadequate culvert or bridge which was part of a drainage project and to replace it with an adequate culvert or bridge. Plaintiff owned land located within a certain area of a judicial ditch. The amount of $700 was awarded to defendant to construct a bridge over said ditch to accommodate a county road. Twice defendant negligently constructed the culvert which resulted in the accumulation of mud and dirt which rendered the ditch ineffective. Plaintiff and other landowners in the area were subsequently assessed for costs resulting from the cleaning of the ditch. Plaintiff then sought to compel defendant to remove and replace the inadequate culvert with an adequate one and to pay the costs of cleaning the drainage ditch. The court denied the relief sought. The court based its decision on the fact that the county is an arm of the state and thus immune from negligence suits. The court indicated that plaintiff might have been successful had he pursued relief on the theory that defendant was benefited by the ditch and consequently subjected to the damages and benefits provisions in the drainage law which determined the method for assessment. (Holt-Fla)
W69-08774

UNITED STATES V TWIN CITY POWER COMPANY (CONDEMNED LAND'S VALUE AS WATER POWER SITE PROPER ELEMENT OF CONDEMNATION VALUE).

215 F 2d 592-601 (4th Cir 1954).

Descriptors: *Federal jurisdiction, *Condemnation, *Condemnation value, *Hydroelectric plants, Compensation, Pondage, Judicial decisions, Property values, Electric power production, Sites, Damsites, Federal Power Act, Legislation, Flood control, Navigable rivers, Legal aspects, Condemnation, Ownership of beds, Federal government, United States, Hydroelectric power.

In connection with water power and flood control development the United States, under the commerce clause, moved to condemn lands owned by defendant power company. The United States appealed the District Court's ruling denying its motions to strike portions of answers asserting that the condemned land's potential as a hydro-electric powersite constituted a permissible element of just compensation. The court of appeals affirmed and held that in arriving at just compensation for private property all elements entering into the value of the property must be taken into consideration. The land in question was bought by the defendant as a water power site and the United States condemned it for the same purpose. The highest and most profitable use for which land is adaptable and likely to be needed in the near future is to be considered. The absolute ownership and right of private property is not varied by the fact that the land borders on a navigable stream. Any lands taken which lie outside the bed of the stream must be compensated for, even when the government's purpose is the improvement of navigation, under its commerce power. While it was true that an adjacent owner does not own the water power value of a river, it is also true that the government does not have any servitude over such adjacent lands. (Blunt-Fla)
W69-08775

RICE HOPE PLANTATION V SOUTH CAROLINA PUBLIC SERV AUTHORITY (DAMAGE FROM SALT WATER INFILTRATION AS A TAKING).
59 SE 2d 132-146 (SC 1950).

Descriptors: *South Carolina, *Eminent domain, *Streamflow, *Encroachment, Saline water, Dams,

Riparian rights, Rivers, Compensation, State governments, Federal government, Federal Power Act, Legislation, Wildlife, Hunting, Fishing, Administrative agencies, Riparian land, Flooding, Saline water intrusion, Legal aspects, Diversion, Damages, Remedies.

Plaintiff corporation owned a large tract of land bordering on two rivers. Defendant Public Service Commission constructed a dam on one of the rivers above plaintiff's property causing a large part of the normal flow of the fresh water to be diverted. Salt water from the ocean infiltrated the streams and creeks decreasing the property value. The water occasionally overflowed when water was released through the dam allowing saline water to flood the land which caused damage. Plaintiff brought suit and sought recovery under 4 theories: (1) compensation for property taken; (2) a cause of action in tort; (3) a cause of action under the Federal Power Act; and (4) a cause of action in quasi-contract. The supreme court held that the Commission as a public corporation was immune from suits ex delicto, that the Federal Power Act did not impose upon a licensee a new liability above what it inherently had, that there was no factual basis for plaintiff's allegation of unjust enrichment and that there was no action in quasi-contract. The court further held that the only theory under which plaintiff could recover was just compensation for property taken. (Helwig-Fla)
W69-08776

IN RE SCIOTO-SANDUSKY CONSERVANCY DISTRICT (FLOOD CONTROL DISTRICTS).
109 NE 2d 51-54 (Ct App Ohio 1952).

Descriptors: *Ohio, *Flood control, *Levees, *Dams, Reservoirs, Multi-purpose projects, Legislation, Judicial decisions, Legal aspects, Rivers, Ohio River, Watersheds, Engineers, Public benefits, Public health, Drainage, Lake Erie, Financing, Federal government.
Identifiers: *Flood district, Scioto River, Sandusky River.

The Scioto-Sandusky Conservancy District was established by a general legislative act. The district adopted its official plan, certain persons objected, and a special hearing was held. The court conducting the hearing approved the plan after certain amendments were made. This ruling was appealed by the objectors. Most of the objections concerned a certain dam and reservoir in two specific counties. In respect to these projects, the official plan called for them to be financed by federal funds. The objectors claimed that during the interim between the plan's adoption and the federal government's action, there will be a long period of uncertainty that would be detrimental to the persons affected. The court held that since the purpose of the plan was to provide for the health and welfare of the public, it must be liberally construed and rejected this contention as mere conjecture. The court said that a few must necessarily be inconvenienced so that a benefit may accrue to many. The court approved the official plan as amended. (Shevin-Fla)
W69-08777

COMMONWEALTH V SONNEBORN (INDUSTRIAL POLLUTION).

164 Pa Super 493, 66 A 2d 584-587 (1949).

Descriptors: *Pennsylvania, *Industrial wastes, *Water pollution sources, Water pollution control, Water pollution, Water pollution effects, Water pollution abatement, Rivers, Lagoons, Streams, Chemical wastes, Public helath, Fish toxins, Animals, Aquatic animals, Legal aspects, Judicial decisions, Administrative agencies.
Identifiers: Sanitary Water Board.

The Commonwealth of Pennsylvania instituted this action against the defendants for illegally discharging industrial wastes, injurious to animal and aquatic life, into Bear Creek and the Allegheny River. The defendant's plant discharged chemical wastes into a lagoon and then cut the bank or dike of the lagoon and drained the waters into the creek and river. By statute, any discharge that is injurious to aquatic life shall be unlawful and a nuisance. The defendant contended that the action would not be considered unlawful unless the Sanitary Water Board determined it as such. The court determined that the defense was affirmative and could only be relied upon if the Board had determined the discharges necessary because of the war. The defendant had made no effort to get a determination by the Board and could thus not rely on this defense. (Shevin-Fla)
W69-08778

NATIONAL BY-PRODUCTS, INC V UNITED STATES (GOVERNMENTAL TAKING BY FLOWAGE EASEMENT).

405 F 2d 1256-1275 (Ct Cl 1969).

Descriptors: *Eminent domain, *Easements, *Floods, *Flood protection, Levees, Floodprofing, Compensation, Federal government, Historic flood, Maximum probable flood, Flooding, Contracts, Banks, Damages, Streams, Streamflow, Riparian rights, United States, Judicial decisions, Legal aspects.
Identifiers: *Flowage easement.

Plaintiff owned property on the south bank of a stream. Defendant, United States, built a levee on the north bank to prevent the flooding of a military installation. Plaintiff alleged that a contract with defendant had been made to build a corresponding levee on the south bank. Plaintiff further alleged that because the government had not built the levee on the south bank, a flowage easement had been taken when plaintiff's land was flooded. He sought compensation for the alleged easement. The court held that the parties had entered into no contract for construction of a levee. It further held that even though the government can appropriate land by flooding, not all flooding is a taking. Plaintiff had to show that the flooding was induced or would inevitably recur and was not merely occasional flooding. The government is not liable for consequential damages arising from its lawful activities. Here defendant did not knowingly induce floods thereby taking flowage easements which would entitle plaintiff to compensation nor could plaintiff show permanent damage from recurring floods. (Helwig-Fla)
W69-08779

TRANSCONTINENTAL GAS PIPE LINE CORP V MR CHARLIE (DAMAGE TO SUBMERGED GAS PIPELINE).

294 F Supp 1025-1034 (E D La 1968).

Descriptors: *Pipelines, *Oil industry, *Drilling, *Law of the sea, Fuels, Natural gas, Oilfields, Oil, Oil wells, Locating, Subsurface mapping, Surveys, Right-of-way, Wells, Judicial decisions, Mines, Navigable waters, Legal aspects, Damages.
Identifiers: *Barges, Major-Minor Fault Doctrine.

Plaintiff owned a gas pipeline laid across the floor of the Gulf of Mexico. The permits and rights-of-way for the pipeline had been properly secured and the location charted. The line ran across a petroleum drilling field. Defendants, an oil company and its drilling contractor, secured an oil and gas lease from the United States. The oil company located the position for a well and began drilling operations. The drilling was accomplished by means of a submersible drilling barge which rested on the ocean bottom. The barge's stabilizing skirts made contact with and damaged plaintiff's pipeline. The court held that the oil company was negligent to a major degree by selecting and locating the proposed well spot and not checking for existing pipelines in the area. The court allowed plaintiff to recover for the damages it its pipeline. (Helwig-Fla)
W69-08780

PETROLEUM PIPE LINES ACROSS FRESH WATER STREAMS.

NJ Stat Ann secs 58:10-24 to 58:10-35.4 (1966).

Descriptors: *New Jersey, *Pipelines, *Fresh water, *Underground storage, Administrative agencies, Administrative decisions, Pipe flow, Permits, Oil, Gases, Streams, Leakage, Remedies, Damages, Regulation, Legal aspects.
Identifiers: Judicial review, Penalties (Civil), Penalties (Criminal).

Extensive regulations govern the construction, operation, maintenance and removal of petroleum pipe lines across fresh water streams in New Jersey so as to prevent pollution via the escape of pipe line contents. Administration of these regulations is by the commissioners of water supply. Detailed notice of alleged violations of these regulations must be given by the commission and hearings held thereon. If the decision of the commission is against the pipe line user or owner, written specifications relative to remedying the defect are required to be submitted to the commission which can approve or disapprove them, substituting therefore its own specifications. Review of the commission's decisions can be had in the superior court. Violators of these regulations are subject to civil and criminal penalties. Regulations also govern the underground storage of petroleum products having as their purpose the prevention of pollution and protection of the public health, safety and welfare. Administration of these regulations is by the commissioner of the Department of Conservation and Economic Development. (Carruthers-Fla)
W69-08781

PETROLEUM PIPE LINES ACROSS FRESH WATER STREAMS.

NJ Stat Ann secs 58:10-24 to 58:10-35 (1966).

Descriptors: *New Jersey, *Pipelines, *Fresh water, *Underground storage, Administrative agencies, Administrative decisions, Pipe flow, Permits, Oil, Gases, Streams, Leakage, Remedies, Damages, Regulation, Legal aspects.
Identifiers: Judicial review, Penalties (Civil), Penalties (Criminal).

After defining 'commission', 'fresh water', and 'pipeline', the statutes prohibit construction, reconstruction, or removal of pipelines across fresh water streams except in a manner approved by the commission and in accord with the statutory provisions. If the commission feels that any pipeline's contents may leak into any fresh water it can hold a hearing with the pipeline owners, and shall give proper notice of the hearing and of its decision regarding danger of escape of pipeline contents. Within 15 days of this decision the owners are to submit specifications for reconstruction of such pipeline which specifications can be approved or substituted for by the commission. Reconstruction shall begin within 30 days of the notice of decision, or else the dangerous portion of the pipeline shall be removed at the owner's expense. For purposes of such removal the commission may freely enter upon lands. Any proceeding of the commission may be reviewed by the Superior Court. Where a ruptured or leaking pipeline causes injury to any fresh water, the commission may apply to the courts for immediate relief. A $500 a day fine is the penalty for pipeline construction in a non-approved manner, with a remedy in damages available to the commission for leakage even if pipelines are constructed in an approved manner. (Carruthers-Fla)
W69-08782

UNDERGROUND STORAGE OF GAS, PETROLEUM PRODUCTS.

NJ Stat Ann secs 58:10-35.1 to 58:10-35.4 (1966).

Descriptors: *New Jersey, *Pipelines, *Fresh water, *Underground storage, Administrative agencies, Administrative decisions, Pipe flow, Permits, Oil, Gases, Streams, Leakage, Remedies, Damages, Regulation, Legal aspects.
Identifiers: Judicial review, Penalties (Civil), Penalties (Criminal).

A permit is required from the Commissioner of the Department of Conservation and Economic Development for natural underground storage of gas and other petroleum products. This act is not applicable to installation of artificial underground storage tanks. The commissioner is empowered to prescribe rules and regulations to effectuate provisions of this act and may impose restrictions on any permit if he considers the same necessary in the public interest to protect the waters of the state. Anyone violating the provisions of the act shall be guilty of a misdemeanor. Every application for a permit shall be accompanied by at least two copies of an accurate map prepared by a competent engineer or geologist showing the location, extent and depth of the proposed storage place and of all wells drilled or proposed to be drilled to such storage place. The commissioner shall determine whether the granting of any such application would be likely to endanger the public safety, health, and welfare and may use in such determination the written report of the Water Policy and Supply Council. (Carruthers-Fla)
W69-08783

IN RE SCHURZ (TITLE TO STREAM BEDS).

278 App Div 309, 104 NYS 2d 395-397 (1951).

Descriptors: *New York, *Stream beds, *Navigable waters, *Ownership of beds, Streams, Streamflow, Channel flow, Floods, Water levels, Tides, Mud flats, Slat marshes, Tidal effects, Damages, Judicial decisions, Legal aspects, Road construction, Relative rights, Beds under water, State governments.

The city of New York sought to acquire title to real property required for street construction. The contest involved rights to certain navigable waters. The claimants asserted title to certain lands which at times were under water. They maintained that the state, if wishing to acquire such lands for street construction, would be required to pay damages. The state contended that the title to the beds was reserved for the sovereign and therefore no damages should accrue. The court held that the grant of land to an individual by a sovereign which included a stream of water subject to the ebb and flow of the tide did not carry with it title to the stream bed. The land in question, the court said, consisted of salt meadows and sledge flats which were under water only at extreme floods and then only to the extent of a few inches. The court held that these flats could not be said to be reserved by the sovereign as part of the stream. The court held that the title to the land involved was in the claimants. The case was remanded so that damages could be awarded. (Shevin-Fla)
W69-08784

WATERSHEDS.
Minn Stat Ann, secs 112.34 to 112.49, 112.65 to 112.85 (1964).

Descriptors: *Minnesota, *Watershed management, *Water conservation, *Flood control, Watersheds (Basins), Erosion control, Legislation, Administrative agencies, Land tenure, Local governments, State governments, Surface runoff, Drainage, Drains, Recreation, Project planning, Dams, Rivers, Water law, Legal aspects, Water supply, Riparian rights, Contracts, Operation and maintenance, Construction, Planning, Financing, Drainage systems, Drainage programs, Public benefits.
Identifiers: *Watershed districts.

The Water Resources Board may establish watershed districts for the purpose of conservation and flood control. The districts shall be established upon petition of local governments or freeholders if the public welfare will be served by such action. Each such district shall be governed by district managers appointed by the Board. The managers shall have the power to do necessary acts to effectuate the purposes of this chapter and of the district. The managers shall plan projects, accept petitions from freeholders for projects, conduct hearings on these projects and carry out the construction of such projects as are deemed beneficial. Costs of the projects may be assessed against land benefited thereby. The managers of a district shall acquire, construct, operate and maintain drainage systems within the district and insure a proper drainage program. The managers may enter contracts of cooperation with other governmental entities for the benefit of the district. Rights of landowners shall not be impaired by projects of the district. No one shall be denied due process in any proceeding by the district. (Helwig-Fla)
W69-08785

ESTABLISHMENT OF WATERSHED DISTRICTS.

Minn Stat Ann, secs 112.34 to 112.411 (1964).

Descriptors: *Minnesota, *Watersheds (Basins), *Watershed management, *Water conservation, Erosion control, Flood control, Legislation, Administrative agencies, Land tenure, Local governments, Land management, Navigable streams, Surface runoff, Drainage, Recreation, Water supply, Hydrology, Beds, Banks, Riparian land, Public health, Public benefits, Land reclamation, Irrigation.
Identifiers: *Watershed districts.

The Minnesota Water Resources Board is empowered to carry out natural resources conservation and flood control by establishing watershed districts. Watershed districts shall be for the purposes of flood control, stream regulation and improvement, land reclamation, irrigation, providing for domestic, industrial and recreational water supply, promoting public health, improving drainage, controlling soil erosion and preserving stream beds and riparian lands. The local governments or the freeholders within a proposed district may petition the Board for establishment of a district. The Board shall hold a public hearing on the petition. If it appears a district would serve the public welfare, the Board shall establish such as a potitical subdivision, name managers thereof and establish a principal place of business. A district shall have perpetual existence and the power to do all authorized acts. A district may be terminated upon a determination, after a petition and hearing, that it no longer serves the public welfare or is no longer needed. (Helwig-Fla)
W69-08786

FUNCTIONS AND AUTHORITY OF WATERSHED DISTRICT MANAGERS.

Minn Stat Ann, secs 112.42 to 112.49 (1964).

Descriptors: *Minnesota, *Watersheds (Basins), *watershed management, *Project benefits, Contracts, Project planning, Water conservation, Erosion control, Drains, Ditches, Dams, Rivers, Legislation, Administrative agencies, Flood control, Land tenure, Navigation, Cities, Water supply, Wildlife, Public health, Projects, Hydrology, Administration, Management.

Upon the establishment of a watershed district in accordance with this chapter, the managers appointed thereto by the Water Resources Board shall meet, organize and conduct business as prescribed. The managers may make surveys and develop projects to accomplish the purposes of the district, enter necessary contracts, constuct and maintain ditches, drains, sewers and watercourses, maintain dams and like facilities, regulate water use, acquire necessary property, purchase needed insurance, gather hydrologic information, maintain, when directed, county drainage systems, control water pollution, adopt rules and regulations to effectuate district purposes and make all necessary reports. The managers shall appoint an advisory committee to advise and assist in matters affecting district interests and may hire necessary employees. They shall adopt an overall plan for the district. Freeholders may petition the managers for projects. The managers shall study such projects and proceed with construction if feasible and in the public interests. Land benefited by any project shall be assessed for the costs thereof. Benefits shall include: drainage improvements; navigation; waste disposal; flood protection; erosion control; increased wildlife; and benefits to cities. (Helwig-Fla)
W69-08787

WATERSHEDS AND DRAINAGE SYSTEMS.
Minn Stat Ann, secs 112.65 to 112.85 (1964).

Descriptors: *Minnesota, *Watersheds (Basins), *Drainage systems, *Watershed management, Contracts, Water conservation, Drains, Ditches, Dams, Dikes, Legislation, Legal aspects, Administrative agencies, Flood control, Land tenure, Local governments, State governments, Federal government, Projects, Bridges, Banks, Construction, Riparian rights, Operation and maintenance.

The managers of a watershed district, when directed, shall take over, operate and maintain any judicial or county drainage system. Construction of all new drainage systems or improvements to existing systems shall be initiated by filing a petition with the managers. If it is necessary to pass a dredge or other equipment through any bridge or grade the district managers shall give the owners thereof 20 days notice to move the structure to allow passage. The district shall pay all costs of removal. The managers may enter contracts of cooperation and assistance with the federal government, state or local governments, corporations or other improvement districts for the improvement of the works of the district, make surveys and maintain dams and dikes. Rights of landowners in the use of waters in the district shall continue as before the establishment of the district but any improvements shall be the property of the district. All prior drainage laws remain in effect except where inconsistent with this chapter. An existing district may be enlarged or reduced by the proper proceedings. (Helwig-Fla)
W69-08788

GENERAL PROVISIONS OF THE SUSQUEHANNA RIVER BASIN COMPACT ARTICLE 15.
Md Ann Code, art 96A:74 (Supp 1968).

Descriptors: *Maryland, *Interstate compacts, *Interstate commissions, *River basins, Governments, State governments, Water policy, Water resources development, Interstate rivers, River basin commissions, Water law, Rivers, Equitable apportionment, Eminent domain, Condemnation, Riparian rights, Legislation, New York, Pennsylvania, Right-of-way, Legal aspects.
Identifiers: Susquehanna River Basin Compact.

This article itemizes the auxiliary powers of the Susquehanna River Basin Commission and the functions of the commissioners in fulfilling the objects and purposes of the Commission. The Commission may make and enforce rules and regulations for the effectuation of the Susquehanna River Basin Compact. The Commission shall have the power to acquire by condemnation the fee or lesser interest in land, land under water, development rights, riparian rights, water rights and other interests within the basin for projects authorized by the compact. The Commission has the authority to locate rights-of-way for aqueducts, lines, pipes, conduits and other facilities required by the Com-

mission. Nothing contained in this compact shall affect or interfere with the law of the signatory parties relating to riparian rights. (Helwig-Fla)
W69-08789

EROSION.

Md Ann Code art 25, secs 161-166 (1957), as amended, (Supp 1968).

Descriptors: *Maryland, *Erosion control, *Structures, *Construction costs, Erosion, Legislation, Local governments, Assessments, Taxes, Bodies of water, Public benefits, Condemnation, Annual costs, Maintenance costs, Diversion structures, Financing, Bonding, Benefits.

Subdivisions of land abutting upon any body of water in the state constitute separate taxing and assessment districts. The county commissioners, acting as a district council, may upon application of 75 per cent of the property owners in a district, construct erosion control structures. Land for construction or maintenance may be taken by purchase or condemnation. The taxing power of the district may be pledged to secure bonds for construction and purchase costs or the district may accept up to 75 per cent of the costs from the state or federal government, financing the remainder through bond issues. When plans for the structure are completed a hearing will be granted to land owners in the district, after which the commissioners shall determine whether to proceed with the structure. Upon completion of any erosion control structure the lands shall be assessed for the costs thereof in proportion to the benefit received. The assessments shall constitute liens on the land to be paid annually as taxes. Additional assessments may be levied annually to defray maintenance expenses and interest costs on the bonds. (Kahle-Fla)
W69-08790

HEALTH.

Md Ann Code art 43, secs 2, 5, 36, 228B, (1965), as amended, (Supp 1968).

Descriptors: *Maryland, *Water pollution control, *Water supply, *Public health, Administrative agencies, Drainage, Diseases, Public benefits, State governments, Legislation, Regulation, Shellfish, Pollution abatement, Pollutants, Sewage disposal, Sewerage, Basins, Water quality control, investigations, Maps, Water pollution sources, Legal aspects.
Identifiers: *State boards of health.

The State Board of Health and Mental Hygiene, pursuant to its duty to make sanitary investigations, may inspect private property in regard to the presence of nuisances and diseases and make rules regulating the character and location of plumbing, drainage, water supply and sewage disposal. The Director of the Board, whenever directed by the governor, shall make special investigations of public institutions and shall advise the legislature and governor in regard to the location of drainage, water supply, waste disposal, ventilation and heating of such institutions. The Board shall examine all public and private water supply systems, prepare maps of the same, control basins of public water systems, investigate and report upon all sources of pollution in water supply systems, and investigate and report upon all private and public systems of sewage disposal. The Board shall restrict the taking or storing of shellfish in waters determined to be polluted. The water in the restricted area must be tested at least twice a month and restrictions lifted when the waters again comply with standards for harvesting shellfish. (Kahle-Fla)
W69-08791

HEALTH.

Md Ann Code art 43 secs 387, 388, 389, 393, 397, 400 (1965), as amended, (Supp 1968).

Descriptors: *Maryland, *Public health, *Water quality control, *Water supply, Water pollution control, Industrial wastes, Pollutants, Permits, Potable water, Municipal water, Public benefits, Regulation, Legislation, Administrative agencies, Pollution abatement, Sewage disposal, Sewerage, Water pollution sources, Legal aspects.
Identifiers: *Sewerage systems.

The terms 'waters of the State', 'sewage', 'waterworks', and 'sewerage systems' are defined. The State Board of Health shall have general control over the waters of the State insofar as their condition affects public health and it may make regulations to correct and prevent pollution. All waterworks and sewerage systems shall be examined and their operation in a manner which will protect public health compelled. The Board may upon request consult with municipalities or private persons as to the most appropriate sources of water supply and the best methods of sewage disposal. It shall also advise industries whose manufacturing may tend to pollute state waters. When the Board finds any waters in danger of pollution because of defective water supply or sewerage systems, it may order the installation of a public system or the completion of the existing system. When waters are polluted by industry, the Board may order cessation of pollution or order alterations in disposal methods. Alteration plans must be submitted by the industry for approval and a permit issued for use of the revised method. The Board shall supervise the bottling of water for potable purposes, and no such water shall be bottled except under permit of the Board. (Kahle-Fla)
W69-08792

PROVISIONS RELATING TO FLOOD CONTROL COMPACT.

Vt Stat Ann tit 10, secs 841-848 (1958), as amended, (Supp 1968).

Descriptors: *Vermont, *Flood control, *Federal-state water rights conflicts, Legislation, Administrative agencies, Dams, Reservoirs, Flood damage, Multiple-purpose projects, Federal government, Political aspects, Cities, Damages, Water resources development, Connecticut, Massachusetts, Water rights, Public lands, Rivers, Taxes, Reimbursable costs, Local governments, Interstate compacts, Interstate rivers.
Identifiers: *Connecticut River Valley, Connecticut River, Economic loss.

The Connecticut River Valley Flood Control Commission shall consists of three members to be appointed by the governor for staggered terms of six years. Vacancies on the Commission shall be filled as provided for by general state law except that the governor may make interim appointments to fill vacancies that come into existence while the state senate is in adjournment. Provisions are made for expenses of the commissioners and appropriations for the Commission. When reimbursement for losses stemming from federal ownership of flood control dams or reservoirs are received from Massachusetts or Connecticut, the state treasurer must notify the state auditor. The board must keep accurate records of all reports issued by the auditor in this regard. The state shall reimburse its political subdivisions for ten per cent of the amount lost to them by reason of the federal ownership of such flood control dams and reservoirs and not reimbursed by Massachusetts or Connecticut. (Shevin-Fla)
W69-08793

DAMS AND DRAINS; GENERAL PROVISIONS.

SC Code Ann secs 18-401 thru 18-411 (1962).

Descriptors: *South Carolina, *Drainage districts, *Water conservation, *Water utilization, Legislation, Levees, Land tenure, Land, Canals, Drains, Ditches, Watercourses (Legal), Damages, Conservation, Costs, Construction, Flood protection, Flood control, Floodwater, Water storage, Erosion control, Waste water disposal, Administrative agencies, Legal aspects, Water storage, Financing.
Identifiers: Obstruction to drainage, Penalties (Criminal), Penalties (Civil).

If any drainage district organized under this chapter is in an area where another district is already established, the newer district shall be known as a subdrainage district. Whoever shall obstruct or damage any drainage works constructed under this chapter shall be guilty of a misdemeanor, subject to fine or imprisonment and be liable for double the cost of removing such obstruction or repairing such damage. Drainage districts may be used as agencies of the state for insuring watershed conservation. The board of supervisors of the district may authorize the development and execution of programs relating to any phase of water conservation, water usage, flood prevention, flood control, control of erosion, floodwater and sediment damages, and may make provisions for constructing such works as they believe necessary to insure conservation and storage of water within the district. Drainage districts may enter into agreements with and receive financial assistance from state agencies, federal agencies, or private landowners. (Shevin-Fla)
W69-08794

LAKE LEVELS INVESTIGATION AND PROCEEDINGS.

NH Rev Stat Ann secs 484:1 thru 485:1 (1968).

Descriptors: *New Hampshire, *Water levels, *Investigations, *Outlets, Legislation, Withdrawal, Administrative decisions, Administrative agencies, Riparian rights, Public benefits, Management, Public rights, Water level fluctuations, Inland waterways, Outlet works, Regulation.

The water resources board may make preliminary investigations of conditions affecting the use of any inland public water of the state. If such investigation indicates that the management and control of any outlet of such public water seriously or adversely affects shore property above or riparian rights below such outlet or the enjoyment of such water by the public, the board may make further investigations and ascertain the respective rights of all interested parties. Even though such management is deemed lawful the board may recommend changes therein that would benefit other interested parties and not injure the owner of the outlet. If the recommended changes would injure the owner or other interested parties the board may estimate damages occasioned thereby and report its findings to the governor. If the owner's actions are unlawful the attorney-general may institute proceedings against him. Unlawful use of an outlet subjects one to a maximum fine of $1000. Withdrawals from Lake Winnipesaukee are statutorily controlled; however, in emergency situations the board has the power to vary the defined withdrawals. (Holt-Fla)
W69-08795

DESIGNATION OF NAVIGABLE STREAMS AND PENALTIES FOR OBSTRUCTION THEREOF.
SC Code Ann secs 70-1 - 70-7 (1962), as amended, (Supp 1968).

Descriptors: *South Carolina, *Navigable rivers, *Obstruction to flow, *Rivers, Bodies of water, Legislation, Streams, Navigable waters, Navigation, Riparian rights, Streambeds, Water pollution, Barriers, Local governments, Public health, Legal aspects, Timber piles, Lumber, Lumbering.
Identifiers: *Obstruction of navigation, Penalties (Criminal).

All streams rendered capable of being navigated by rafts of timber or lumber and all navigable watercourses are declared navigable streams. They shall be common highways and forever free to all inhabitants of this state and all citizens of the United

States. Anyone obstructing such a stream shall be guilty of a nuisance. Anyone cutting trees or logs or throwing refuse into any navigable stream or anyone floating logs so as to obstruct any river shall be guilty of a misdemeanor. All timber or rafts floating so as to be dangerous to navigation shall be captured and sold at market. All riparian landowners shall keep clean all streams adjacent to their land. Certain enumerated counties shall be exempt from provisions of section 70-3 and 70-4 of this title pertaining to obstruction of navigable streams. The cutting or felling of trees into streams in certain enumerated counties so as to lessen the flow or endanger the community health shall be a misdemeanor. (Helwig-Fla)
W69-08796

WATER POLLUTION (POWERS OF COMMISSION IN RELATION TO POLLUTION).

Del Code Ann tit 7, secs 6301-6306 (Supp 1966).

Descriptors: *Delaware, *Pollution abatement, *Water pollution control, *Administrative agencies, State governments, Public health, Industrial wastes, Sewage, Regulation, On-site investigations, Legal aspects, Administration, Research and development, Recreation, Public rights, Investigations, Legislation, Administrative decisions.
Identifiers: *Summary proceedings, *Injuctions (Prohibitory), Public hearings, Water and Air Resources Commission.

It is part of the public policy of this state to prevent new pollution of the state's water and to control existing pollution. The Water and Air Resources Commission has jurisdiction to regulate water pollution by enforcing the laws relating to water pollution. The commission shall study and investigate all problems of pollution and recommend solutions. Also the commission shall adopt regulations for the installation of systems to control pollution. The commission may issue orders directing private persons or other political entities to control pollution. To insure compliance with its orders the commission may make investigations and inspections. The commission may at reasonable times inspect any industrial or municipal establishment for conditions relating to pollution. Also the commission may require information from any person pertinent to the commission's duties. When the commission's orders are not complied with, the commission may seek an injunction to prevent further violations. The commission may institute immediate action to protect public health by issuing a written directive ordering the cessation of pollutant discharges. As soon as possible thereafter, a hearing must be given to persons directed to so cease. (Gadd-Fla)
W69-08797

TAX DITCHES.

Del Code Ann tit 7, secs 4185-4193 (1953), as amended, (Supp 1966).

Descriptors: *Delaware, *Administrative agencies, *Drainage districts, *Land management, Drainage, Legislation, Regulation, Jurisdiction, Ditches, Taxes, Government finance, Water law, Legal aspects, Land, Permits, Maintenance, Drainage programs, Maintenance costs, Financing, Operation and maintenance.
Identifiers: *Tax ditches.

Ditch managers are responsible for removal of obstructions and repair of ditches caused by persons either willfully or negligently when, after a warning, such persons refuse to correct a situation caused by them which damages a drainage system. Such person is liable for all loss or injury caused by his actions. Upon petition to and approval by the superior court a ditch order may be amended so as to allow a landowner to be included in a tax ditch formed under provisions of this chapter. When land drains into a tax ditch when said land's owner is not a member of same, such landowner is responsible for the cost necessary to adding his lands to the ditch order and is subsequently liable for taxes on same. A tax ditch may be changed as deemed necessary by majority vote of the taxables present at regularly called tax ditch meetings. A tax ditch may be dissolved in a similar manner. Bridges and culverts under public roads as well as ditches near highways are maintained at the expense of the state. (Johnson-Fla)
W69-08798

OBSTRUCTIONS AND DAMAGE TO ROADS.

SC Code Ann secs 33-491, 33-493, 33-496 thru 33-500 (1962).

Descriptors: *South Carolina, *Drainage, *Highways, Surface drainage, Ditches, Drainage effects, Culverts, Railroads, Industrial water, Bridges, Dams, Canals, Channels, Lakes, Reservoirs, Flooding, Obstruction to flow, Roads, Flow augmentation, Legislation.
Identifiers: *Obstruction to drainage, Highway damage, Penalties (Criminal).

No person shall obstruct ditches and drainage openings along any highway. Nor shall any railroad company obstruct the drainage of any public road, or empty water from its ditches into any public road, so as to cause injury to such road. Special provisions are made for the establishment of proper and sufficient drainage of highways in Newberry, Pickens and Saluda County. Violations of these sections subject the violator to a fine and/or imprisonment. (Shevin-Fla)
W69-08799

FISH, GAME: MISCELLANEOUS PROVISIONS.

SC Code Ann secs 28-3, 28-8, 28-8.1 (1962).

Descriptors: *South Carolina, *Fishing, *Recreation, *Land tenure, Fish, Streams, Navigable waters, Lakes, Legislation, Legal aspects, Regulation, Sport fishing, Hunting, Game birds, Trapping, Banks, Permits, Wildlife management.

All wild game, birds and fish, except fish inhabiting strictly private waters, are the property of the state. Any person entering upon another's lands for the purpose of hunting, fishing or trapping, without the consent of the owner, shall be guilty of a misdemeanor. No one shall fish or hunt from the banks of a navigable stream without the landowner's permission and consent. Such consent should be in writing if the owner might not be within 1 mile of the place where the person may be caught in the act of so fishing or hunting. (Carruthers-Fla)
W69-08800

FISH, GAME: ACQUISITION OF RIGHTS-OF-WAY.

SC Code Ann sec 28-141 (1962).

Descriptors: *South Carolina, *Right-of-way, *Land use, Public rights, Public benefits, Administrative agencies, Rivers, Tributaries, Streams, Leases, Legislation, Legal aspects, Land, Land tenure, Fish, Fishing, Sport fishing, Recreation, Compensation, Access routes.
Identifiers: Catawba River, Public access.

To insure reasonable public access to the Catawba River and its tributaries, the Division of Game may contract with landowners contiguous to said waters for public rights of ingress and egress over their lands to such waters. Such rights-of-way shall be leased for such terms as may be agreed upon between the Division and the landowners. If compensation need be paid, it shall come from the game fund of York County. (Carruthers-Fla)
W69-08801

LICENSES; RESTRICTIONS ON FISHING.

SC Code Ann secs 28-551, 28-551.1, 28-571, 28-572, 28-575 thru 28-602 (1962), as amended, (Supp 1968).

Descriptors: *South Carolina, *Regulation, *Fishing, *Fish, Fly fishing, Ponds, Non-sport fish, Sport fish, Trapping, Seines, Fish hatcheries, Fish stocking, Fishing gear, Legal aspects, Fish management, Control, Seasonal, Legislation, Permits.
Identifiers: Night fishing, Limits, Licenses.

These regulations pertain to the regulation, management, and control of fishing. They establish how and where game fish may be caught, what methods of fishing are prohibited and other regulations concerning night fishing, trout season, and daily creel limits on game fish in general. Regulations applicable to pond owners and the laws against trespass on ponds used to breed fish or oysters are also included. (Moulder-Fla)
W69-08802

SPECIAL PROVISIONS FOR GAME ZONE NO 7.

SC Code Ann secs 28-661 thru 28-669 (1962), as amended, (Supp 1968).

Descriptors: *South Carolina, *Fishing, *Fishing gear, *Fish conservation, Fish management, Fish populations, Fish types, Herrings, Shrimp, Streams, Baits, Bait fishing, Gill nets, Catfishes, Legislation, Legal aspects, Water policy, Reasonable use, Wildlife conservation, Sport fishing, Nets, Fly fishing, Water sports, Regulation, Seasonal, Control.
Identifiers: Licenses, Penalties (Criminal).

It shall be unlawful for any person to use or possess fish nets, seines, trotlines or set hooks or to shoot or gig fish at any time of year in any of the waters of Game Zone No 7. This section does not apply to shad, herring or shrimp fishing. This article shall not apply to persons fishing for sport with the appropriate equipment. A set hook is a baited hook and line attached to a set pole along the bank. It shall be unlawful to sell or possess fish nets. Notwithstanding the above section, during certain months, gill nets of a certain size may be used in Game Zone No 7. It shall be permissible to use 3 inch nets for taking herring from the Great Pee Dee River during open season. It shall be unlawful to use any light or gig to take fish in this Game Zone. Game wardens shall confiscate and destroy all illegal fishing devices. This article shall not apply to persons fishing for catfish with a license to use fish traps. Violators of provisions of this article shall be guilty of a misdemeanor. Any person having in his possession, going to or coming from any waters, fish in excess of the legal limit shall be presumed to have killed or caught such fish. (Carruthers-Fla)
W69-08803

DUTIES AND POWERS OF THE STATE DEVELOPMENT BOARD.

SC Code Ann sec 9-310 (1962).

Descriptors: *South Carolina, *Administrative agencies, *Administration, *State governments, Legislation, Water law, Water policy, Legal aspects, Regulation, Organizations, Water rights, Riparian rights, Eminent domain, Water, Flood control, Erosion control, Condemnation, Construction, Operation and maintenance, Ditches, Dams, Reservoirs, Bridges, Bridge construction.

With the abolition and consolidation of a great number of boards and commissions within the state government, including the South Carolina Intra-Coastal Waterway Commission and the Natural Resources Commission, the State Development Board takes on a number of widely ranging duties and powers. The Board may build, maintain, and operate lakes, fills, dams, reservoirs, ditches, drains, culverts, and bridges. Prevention and con-

trol of soil erosion and flood control are responsibilities of the board. It may acquire by purchase, gift or condemnation any lands, waters, water rights, riparian rights or flowage rights useful in carrying out its powers. (Johnson-Fla)
W69-08804

ELECTRICITY.
SC Code Ann sec 24-12 (1962).

Descriptors: *South Carolina, *Electric power production, *Easements, *Right-of-way, Legislation, Condemnation, Transmission lines, Electric powerplants, Substations (Electrical), Dams, Impounded waters, Electric power, Legal aspects, Real property, Public utilities, State governments, Rural areas.
Identifiers: Rural electric cooperative.

Electric companies, state authorities, and rural electric cooperatives are granted the right to acquire rights-of-way, easements, and property for constructing and operating power lines and for constructing electric plants and impounding water. The procedure for obtaining rights-of-way is the same as under sections 58-301 through 58-313 of this code which pertain to telegraph and telephone companies. Easements and property may be obtained under the procedure set up for condemnation under section 58-302. No public lands used for the generation or the transmission of electricity may be condemned. (Gadd-Fla)
W69-08805

WATER POLLUTION CONTROL AUTHORITY--RULES AND REGULATIONS.

17 SC Code Ann 471-478 (1962).

Descriptors: *South Carolina, *Administrative agencies, *Water pollution control, *Standards, Permits, Administration, Adjudication procedure, State governments, Regulation, Inspection, Water pollution, Water treatment, Waste water treatment, Water pollution treatment, Sewage treatment, Treatment facilities, Pollutants, Water quality control, Legislation, Civil engineering, Classification.
Identifiers: Waters classification, Administrative hearings.

Generally, standards applicable to waters which receive sewage, industrial wastes or other wastes are to be such that these discharges do not impair the best usage of the waters. Compliance with standards is shown by tests or analytical determinations following standard procedures set up by the Authority. Standards of quality and purity are established for the following classes: (AA) for domestic use and food processing with sterilization only required; (A) for swimming water; (B) for domestic use after complete treatment; (Ca) for fish survival, industrial uses, and other uses; and (D) for waters receiving wastes with no known treatment. Provisions are made for application to the Board of Health for any new disposal systems, alterations in existing systems, and increased discharges. Procedures for hearings are outlined, requiring a report of findings by an examiner in all cases. Before discharging any sewage or wastes into state waters, increasing discharge, or altering treatment processes, the party involved must make application to the Authority and file a report prepared by a qualified engineer describing steps taken to prevent pollution. No construction may commence on such projects without permit from the Authority. (Douberley-Fla)
W69-08806

FENCES.

Ill Ann Stat ch 54, sec 26 (Smith-Hurd 1967).

Descriptors: *Illinois, *Construction, *Safety, *Safety factors, Wells, Cisterns, Cesspools, Quarries, Recharge, Basins, Excavation, Sumps, Legislation, Legal aspects, Public benefits, Public health.
Identifiers: *Fences, Protective fencing, Penalties.

Any person or business owning, maintaining, using or abandoning any open well, cesspool, cistern, quarry, recharging basin, catch basin, sump or other excavation without covering or surrounding same with protective fencing is guilty of a misdemeanor. Upon conviction such person shall be fined or imprisoned or both. These provisions are not applicable while such structures are guarded by a watchman or while a workman is present performing services thereon. (Carruthers-Fla)
W69-08807

GENERAL PROVISIONS; PORTS AND MARITIME MATTERS.

SC Code Ann secs 54-101 thru 54-146 (1962).

Descriptors: *South Carolina, *Navigable waters, *Administrative agencies, *Port authorities, Cities, Riparian rights, Docks, Harbors, Right-of-way, Construction, Regulation, Damages, Legislation, Bays, Rivers, Streams, Dredging, Channel improvement, Ships, Facilities, Damages, Public utilities, Jurisdiction.
Identifiers: Obstruction to navigation, Negligence, Elections, Penalties (Civil).

Any city having a population of over fifty thousand persons and located upon a navigable stream, may purchase or otherwise acquire any lands, riparian rights, rights-of-way, or other property for the construction of a port facility. A port utilities commission shall be established for the city. Provisions for the election and terms of the commissioners and the methods of filling vacancies are set forth. The commission may adopt a seal and sue and be sued in the courts of the state. They may also charge reasonable rates for use of such facilities. Any damages caused to persons as a result of negligence in connection with the port facilities, may be recovered in an action against either the city or the commission. The commission may not incur indebtedness without the express authority of the city council. The State Ports Authority shall have jurisdiction over the bay of Charleston and shall provide for safe use of the same by vessels entering the harbor. (Shevin-Fla)
W69-08808

GASSAWAY V TRAVELERS INS CO (DAMAGE FROM UNDISCLOSED STORM SEWER).

439 SW 2d 605-610 (Tenn 1969).

Descriptors: *Tennessee, *Storm drains, *Drainage, *Subsurface runoff, Drains, Conduits, Drainage systems, Intakes, Pipes, Land tenure, Surface runoff, Judicial decisions, Legal aspects, Damages, Insurance, Risks, Construction, Foundations, Accidents, Remedies.
Identifiers: Open-throat inlet, Negligence.

Plaintiffs owned a residence beneath which defendant's insured had constructed an underground storm sewer. Plaintiffs and their grantors had no knowledge of the drainage facilities. Defendant had contracted to insure the builder of the residence against liability for accidental injury to the property. Water discharging from the drainage facilities caused the foundation of plaintiffs' house to settle. Plaintiffs obtained a judgment against the builder and sought in the court of chancery to collect on the judgment from defendant insurer. From a finding for plaintiffs, defendant appealed. The supreme court reversed, holding that in order for plaintiffs to collect the damage must result from an accident. The builder sold the lot with the knowledge of the existing drainage facilities along with the risks involved and had reason to believe that subsequent purchasers would not discover such conditions. The damages resulted from the negligence of the builder in not disclosing the adverse condition and potential damages which he could have reasonably foreseen. The damages did not result from an accident but from the builders negligence, and were not covered by the terms of the policy. (Helwig-Fla)
W69-08809

LAKE CHARLES HARBOR AND TERMINAL DIST V HENNING (EMINENT DOMAIN PROCEEDINGS IN PORT IMPROVEMENT).

409 F 2d 932-937 (5th Cir 1969).

Descriptors: *Louisiana, *Eminent domain, *Administrative agencies, *Harbors, Land tenure, Planning, Compensation, Judicial decisions, Legal aspects, Condemnation, Condemnation value, Local governments, Land appraisal, Port authorities, Storage tanks, Public benefits, Public rights, Jurisdiction, Adjudication procedure.
Identifiers: Harbor districts.

A harbor district brought expropriation proceedings for land as bulk storage facilities in a plan to improve the port. The nonresident landowners removed to the federal district court. The court held the land was expropriated for a public purpose and the court of appeals affirmed. The district's action did not violate the due process requirements of the fourteenth amendment since the district planned to construct bulk handling facilities of port commodities as an integral part of a port improvement plan. Although there was only one prospective user, the use was still public since any potential user had the same opportunity for use. There need not be actual immediate necessity for expropriation as long as there was a demonstrated future need and intended construction of the facilities within a reasonable time. The court refused to interfere with the district's discretion concerning the extent of property taken. The court also upheld the method of valuation by averaging four expert appraisals and the awarding of expert witness fees to the landowners as costs or as part of just compensation. (Breeze-Fla)
W69-08810

STATE HIGHWAY COMM'N V RISS (CONDEMNATION VALUE OF LAKE PROPERTY).

432 SW 2d 193-200 (Mo 1968).

Descriptors: *Missouri, *Condemnation, *Condemnation value, *Property values, Eminent domain, Right-of-way, Highways, Road construction, Lakes, Land development, Land use, Administrative agencies, Administrative decisions, Judicial decisions, Legal aspects, Water law, Landfills, Water rights, Flooding, Damages.

Defendant landowner was awarded $66,000 for part of a 680 acre tract condemned and taken by the state for highway purposes. Exceptions were taken regarding the condemnation value of the property taken and a jury awarded defendant $125,000. Defendant appealed from this latter award contending that the presence of a man-made lake, one end of which the proposed highway was to cross, enhanced the value of the property for development purposes to $1,342,500. Defendant's witness testified that this value figure was reached by a capitalized method of valuation and also that presence of the highway would destroy the value of the property for development purposes. The court agreed that the best use of defendant's property may have been prevented by the condemnation but that unless defendant was in such a position to have carried out such development at the data of the taking, value for development purposes could not enter into the damage computation. The court held, therefore, that the fact that the lake enhanced the value of the porperty for development purposes did not justify use of a capitalized method of valuation and affirmed the jury award of $125,000. (Carruthers-Fla)
W69-08811

KENTON COUNTY WATER DIST V ROGERS (JURY DAMAGES AWARD IN CONDEMNATION PROCEEDINGS).
433 SW 2d 891-893 (Ky 1968).

Descriptors: *Kentucky, *Condemnation value, *Easements, *Water storage, Storage tanks, Condemnation, Right-of-way, Conduits, Judicial decisions, Land tenure, Eminent domain.
Identifiers: *Highest and best use, Subdivision property, Enhancement value.

In a condemnation proceeding, condemnor obtained 1.72 acres of land on a 30 acre farm for the construction of a water-storage tank. Condemnor also obtained easements for a roadway and a sixteen inch water main. The jury awarded condemnees $9,000 after expert witnesses established the highest and best use of the land as subdivision property. On appeal by condemnor, the Court of Appeals of Kentucky held that although some of condemnee's witnesses lacked knowledge of subdivision property values, and others failed to allow enhancement value from the new roadway, the jury did not award excessive damages to condemnees. The court of appeals affirmed the jury award. (Harris-Fla)
W69-08812

FISH AND GAME.

NH Rev Stat Ann secs 206:10, 206:16 (1964).

Descriptors: *New Hampshire, *Wildlife conservation, *Fish conservation, *Regulation, Conservation, Fishing, Hunting, Seasonal, Legislation, Administrative agencies, Resource development, Crayfish, Fish management, Fishing gear, Bodies of water, Birds, Wildlife, Wildlife management, Legal aspects.

It is the duty of the director of fish and game to protect, propagate and preserve fish, game, bird and wildlife resources of the state. He has the power to make and enforce rules and regulations for such purposes, including the authority to open and close the season for taking fish, setting number, weight and size limits for fish, and the manner of taking of fish. Such authority may be exercised over the state as a whole or over any county, part thereof, or body of water. Such authority shall not extend to regulation of seasons for taking game, birds or other wildlife, or the limits of the same. The director has power to close any body of water to the taking of crayfish for any length of time necessary in order to protect the crayfish population of such body of water. (Kahle-Fla)
W69-08813

ATLANTIC MARINE FISHERIES.
NH Rev Stat Ann secs 213:1-213:6 (1964), as amended, (Supp 1967).

Descriptors: *New Hampshire, *Interstate compacts, *Marine fisheries, *Atlantic Ocean, Shellfish, Anadromous fish, Marine fish, Commercial fishing, Sport fishing, Regulation, Legislation, Administrative agencies, Fish conservation, Fisheries, Fishing, Fish management, Interstate commissions.

The provisions of the Atlantic States Marine Fisheries Compact are set out. The purpose of the compact is to promote better use of Atlantic seaboard fisheries through development of a joint program. The compact shall become effective whenever two of the listed Atlantic states have executed it. Each signatory state is to appoint three representatives to an interstate commission which shall ascertain methods to conserve marine, shell anadromous fisheries. The commission shall draft and recommend legislation to the various states, advise administrative agencies as to problems of fisheries and recommend stocking programs. The federal fish and wildlife service of the department of the interior shall act as a research agency for the commission. An advisory committee of commercial fishermen and salt-water anglers shall be set up to advise the commission. Each member state agrees to contribute to the support of the commission in proportion to the value of its fisheries' products. Each state initially agrees to contribute an amount based upon the catch record of 1938. Subsequent budgets will be recommended by a majority of the commission. An amendment to the compact allows joint regulatory agencies among consenting states with respect to common fisheries. The governor of New Hampshire is authorized to execute the compact on behalf of New Hampshire. The New Hampshire commission members are the fish and game director, a legislator who is a member of the commission on interstate cooperation, and a private citizen appointed by the governor. (Kahle-Fla)
W69-08814

BRIDGES.
Vt Stat Ann tit 19, secs 1601-1604, 1621-1625, 1711-1718 (1968).

Descriptors: *Vermont, *Bridges, *Operation and maintenance, *Management, Administrative agencies, Costs, Cost transfer, Cost repayment, Bridge construction, Bridge design, Maintenance, Maintenance costs, Operating costs, Legislation, Legal aspects, Administration, Local governments, Cities, Eminent domain, Roads, Highways, Appropriation, Financing, Culverts, Transportation, State governments, Political aspects.
Identifiers: *Covered bridges, *Toll bridges, Penalties (Civil), Drawbridges.

Operation, maintenance and all powers incidental thereto vested in the Missisquoi Bay Bridge Commission are transferred to the state highway board. The board shall: (1) operate and maintain the Missisquoi Bay bridge; (2) assume outstanding liabilities created by the Commission; (3) pay outstanding notes of said Commission; and (4) accept and receipt for cash turned over to the board by said Commission. The board shall maintain, toll free, the sandbar bridge and the highway extending southerly therefrom. The selectmen shall cause covered bridges, located where a highway approaches such bridge from an angle, to contain openings on the side facing the highway. The use of covered bridges may be restricted to vehicles in regard to weight, height, and width. Voting procedures respecting the establishment of such restrictions and penalties for violations of such restrictions are provided. Public notice shall be given of the intent to destroy or remove a covered bridge. Drawbridges conveyed to the state shall be operated and maintained by the state. State highway board members shall also be toll bridge commissioners, and shall have the power of eminent domain, the authority to make agreements regarding the freeing of toll bridges, the authority to reimburse towns for their freeing of toll bridges and shall have general supervision over such freed toll bridges as are in Vermont. Any person crossing toll bridges without paying the toll shall be fined. (Carruthers-Fla)
W69-08815

DISPOSAL OF WASTEWATER FROM WATER FILTRATION PLANTS.

Am Watrwks Ass'n J Vol 61, No 7, p 322-326, July 1969. 5 p, 2 ref.

Descriptors: *Water purification, *Waste water disposal, *Waste water treatment, *Water pollution sources, Coagulation, Flocculation, Filtration, Sludge treatment, Freezing, Financial feasibility, Chemical reactions, Density, Beds, Sedimentation, Sediment discharge, Suspension, Turbidity, Chemical analysis, Water chemistry, Filtering systems, Quality control, Settling basins.
Identifiers: Water filtration plants, Precoat vacuum filter, Alum recovery.

Recent changes in standards of many states have classified the waste flows from water filtration plants as potential pollutants. Although such waste flow consists only of the same solids that would normally be found in the stream, they are potential pollutants because their increased concentration may inhibit biological activity in beds where they settle and because they would be readily discernible and easily stirred up by turbulence in the receiving water. Four possible methods for treating such pollutants are briefly discussed. There are: (1) disposal to the sewerage system for treatment; (2) filtration on a precoat vacuum filter; (3) freezing to change the character of the gelatinous hydroxide to granular form; and (4) alum recovery by regeneration with sulfuric acid. The advantages and drawbacks, including the financial feasibility of each method is discussed. The freezing process is suggested as most advantageous where land area is available for sludge volume produced and where suitable winter temperatures occur. Alum recovery is cited as most advantageous for large filtration plants where round-the-clock operation could be maintained. (Kahle-Fla)
W69-08816

PURE WATER DEVELOPMENT ACT.

111 Ann Stat ch 19, secs 1021-1 thru 1021-5, 1022-1 thru 1022-5, 1023-1 thru 1023-7 (Smith-Hurd Supp 1969).

Descriptors: *Illinois, *Administrative agencies, *Recreation facilities, Sewage treatment, Water pollution, Water pollution treatment, Land use, Recreation, Government finance, Local governments, Municipal wastes, Industrial wastes, Loans, Grants, State governments, Federal government, Water conservation, Water resources development, Treatment facilities.

The Pure Waters Board is authorized to assist the financing of programs for the conservation and development of natural resources from funds derived under the Pure Waters Development Bond Act. The Board may finance the acquisition by state agencies of land to be used for recreational facilities provided such financing is necessary and will be matched by local funds. The project must have been approved by the appropriate planning commission and conform to the statewide outdoor recreation plan. No property so acquired may be converted to other use without permission of the Board. The Board may also make grants or loans to municipalities, sanitary districts or intermunicipal and interstate agencies for construction of sewage treatment facilities. Grants must be necessary for completion of the project and may not exceed 30% of the estimated cost thereof. Such projects must comply with federal regulations, be effective in reducing pollution to an acceptable level, be in compliance with current regulations of the Board, and be approved by the appropriate planning commission. The Board is authorized to establish a loan guarantee program to assist private industry in the purchase of pollution control devices. (Kahle-Fla)
W69-08817

KASKASKIA RIVER WATERSHED.
Ill Ann Stat ch 19, sec 41.1 (Smith-Hurd Supp 1969).

Descriptors: *Illinois, *Administrative agencies, *Watersheds (Basins), *Water resources development, Land use, Regulation, Legislation, Contracts, Navigation, Flood control, Drainage, Water supply, Levees, Rivers, Dams, Water utilization, Watershed management.
Identifiers: Kaskaskia River, Carlyle Dam.

The Department of Public Works and Buildings may independently contract with any federal agency, political subdivision of the state, private party or corporation in connection with navigation, flood control, drainage, levee, water supply and water storage, to be used in the development of the Kaskaskia River watershed including restriction on use or withdrawal of water from the river below Carlyle Dam. The Department shall have jurisdiction and supervision over all phases of the develop-

ment of such basin and control over all lands acquired in connection therewith. The Department may grant, lease, sell, exchange, or otherwise use such land in any manner not inconsistent with the purposes for which it was acquired. (Kahle-Fla)
W69-08818

REMOVAL OF OBSTRUCTIONS.

Ill Ann Stat ch 19, secs 47a-47e (Smith-Hurd 1963).

Descriptors: *Illinois, *Boats, *Boating regulation, *Salvage value, Ships, Navigation, Navigable waters, Damages, Lumber, Legislation, Administrative agencies, State jurisdiction, Remedies, Streams, Bodies of water, Buoys, Obstruction to flow, Administrative decisions, Barriers, Marking techniques.
Identifiers: *Obstruction to navigation, *Sunken vessels, Penalties (Fines), Wrecks.

It is unlawful to obstruct navigation by anchoring vessels, voluntarily or carelessly sinking vessels, or floating timber in navigable waters of the state. Sunken craft must be marked by their owners with buoys and lighted lanterns until removed. Failure to promptly remove such craft shall be considered an abandonment. When such abandonment has existed for more than 30 days, notice may be given to the owner. After an additional 30 days the vessel may be removed and disposed of by the Department of Public Works and Buildings. After such notice, the Department may advertise for bids for the removal of the wreck. Money received from the sale of the wreck or from the contractor removing the wreck shall be paid to the state. If such amount is insufficient to reimburse the state for expenses, the owner of such wreck shall be liable for the difference. Vessels sinking, grounding, or unnecessarily delayed in navigable waters may be immediately removed or destroyed by the Department in order to clear the waters. Removal costs shall be a charge against such vessels. If not paid within 30 days, such costs may be recovered by selling the vessel or cargo at public auction with the owner remaining liable for expenses not reimbursed. Violations of these provisions are misdemeanors punishable by fine and/or imprisonment. (Kahle-Fla)
W69-08819

WAUKEGAN PORT DISTRICT.

Ill Ann Stat ch 19, secs 180, 182.1-182.4, 192 (Smith-Hurd 1963).

Descriptors: *Illinois, *Administration, *Navigable waters, *Regulation, Legislation, State governments, Administrative agencies, Navigation, Harbors, Permits, Boating regulations, Docks, Coastal structures, Jetties, Bulkheads, Bulkhead line, Breakwaters, Bridges, Engineering structures, Weirs, Deposition (Sediments), Abatement, Rock excavation, Rock fills, Excavation, Dredging, Shores, Seashores, Bridge construction, Piers, Boats, Anchors, Construction, Landfills, Legal aspects.
Identifiers: Navigational obstructions, Penalties (Criminal).

Navigable waters are defined as any public waters usable for commerce. The Waukegan Port District is empowered to issue permits for construction of all structures within forty feet of any navigable waters and for removal or deposit of any material in navigable waters. Plans, profiles and specifications for the fill or construction must be submitted to the Port District before issuance of permits. A maximum penalty of $5,000 or one year imprisonment is imposed for failure to secure a permit, and any activity may be abated or modified at the discretion of the Port District. The District is also empowered to prevent or remove obstructions in navigable waters, locate and establish dock lines and shore or harbor lines, regulate water vessels, and regulate the operation of bridges. (Douberley-Fla)
W69-08820

JOLIET REGIONAL PORT DISTRICT.

Ill Ann Stat ch 19, secs 252.14, 254.1-254.4 (Smith-Hurd Supp 1969).

Descriptors: *Illinois, *Legislation, *Administration, *Navigable waters, State governments, Administrative agencies, Navigation, Harbors, Permits, Regulation, Boating regulations, Docks, Coastal structures, Jetties, Bulkheads, Bulkhead line, Breakwaters, Bridges, Engineering structures, Weirs, Depositions (Sediments), Abatement, Rock fills, Shores, Seashores, Bridge construction, Piers, Boats, Anchors, Construction, Landfills, Legal aspects.
Identifiers: Nagivational obstructions.

Navigable waters are defined as public waters usable for commerce. The Joliet Regional Port District is empowered to issue permits for construction of all structures within fifty feet of any navigable waters and for deposit of any material in navigable waters. The District may also prevent or remove obstructions in navigable waters, locate and establish dock lines and shore or harbor lines, regulate water vessels, and regulate operation of bridges. (Douberley-Fla)
W69-08821

SHAWNEETOWN REGIONAL PORT DISTRICT.

Ill Ann Stat ch 19, secs 402.14, 404, 404.1, 414 (Smith-Hurd 1963), as amended, (Supp 1969).

Descriptors: *Illinois, *Administration, *Navigable waters, *Regulation, Legislation, State governments, Administrative agencies, Navigation, Harbors, Permits, Boating regulations, Docks, Coastal structures, Jetties, Bulkheads, Bulkhead line, Breakwaters, Bridges, Engineering structures, Weirs, Deposition (Sediments), Abatement, Rock excavation, Rock fills, Excavation, Dredging, Shores, Seashores, Bridge construction, Piers, Boats, Anchors, Construction, Levees, Cities, Landfills, Legal aspects.
Identifiers: Navigational obstructions, Penalties (Criminal).

Navigable waters are defined as public waters usable for commerce. The Shawneetown Regional Port District is empowered to issue permits for: (1) construction of all structures within forty feet of any navigable waters, except for bridges which cross waterways used as state boundaries and are operated by the city; and (2) deposit of any fill materials in navigable waters. Plans, profiles and specifications for the fill or construction must be submitted to the Port District before issuance of permits. A maximum penalty of $5,000 or one year imprisonment is imposed for failure to secure a permit, and any activity may be abated or modified at the discretion of the Port District. The Port District may also: prevent or remove obstructions in navigable waters; locate and establish dock lines and shore or harbor lines; regulate water vessels; regulate operation of bridges, with the exceptions noted above; and build, repair and maintain levees. (Douberley-Fla)
W69-08822

SOUTHWEST REGIONAL PORT DISTRICT.

Ill Ann Stat ch 19, secs 452.14, 454, 467 (Smith-Hurd 1963).

Descriptors: *Illinois, *Administration, *Navigable waters, *Regulation, Legislation, State governments, Administrative agencies, Navigation, Harbors, Permits, Boating regulations, Bulkhead line, Breakwaters, Bridges, Engineering structures, Weirs, Deposition (Sediments), Abatement, Rock excavation, Rock fills, Excavation, Dredging, Shores, Seashores, Bridge construction, Piers, Boats, Anchors, Construction landfills, Legal aspects.
Identifiers: Navigational obstructions, Penalties (Criminal).

Navigable waters are defined as public waters usable for commerce. The Southwest Regional Port District is empowered to issue permits for: (1) construction of all structures within forty feet of any navigable waters, except for bridges which cross a waterway used as a state boundary and are operated by any city; and (2) deposit of any fill materials in navigable waters. Plans, profiles and specifications for the fill or construction must be submitted to the Port District before issuance of permits. A maximum penalty of $5,000 or one year imprisonment is imposed for failure to secure a permit, and any activity may be abated or modified at the discretion of the Port District . The District may also: prevent or remove obstructions in navigable waters; locate and establish dock lines and shore or harbor lines; regulate water vessels; and regulate operation of bridges, with the exceptions noted above. (Douberley-Fla)
W69-08823

NATURAL RESOURCES DEVELOPMENT BOARD.

Ill Ann Stat ch 19, secs 1071 thru 1077. 13 (Smith-Hurd Supp 1969).

Descriptors: *Illinois, *Administrative agencies, *Water resources development, *Water conservation, Water resources, Water quality, Watersheds (Basins), Navigation, Rivers, Legislation, Regulation, Government finance, State governments, Federal government, Project planning, Water supply, Flood control, Project purposes.

The Natural Resources Development Board is created in order to insure proper planning for the conservation and development of water resources. The members of the board shall be the directors of certain related state agencies and shall serve without compensation. The Board shall prepare a biennial assessment of the quality and quantity of available water resources and recommend legislation to insure adequate future supplies. In addition the Board shall: disseminate information to citizens regarding water supply programs; advise the governor on proposed federal and state legislation; implement policies to insure coordination of state agencies; examine state projects, identify areas where new projects are needed, and report to the governor thereon; represent the state in federal projects involving more than one state agency in matters of navigation, flood control, rivers, and watersheds; administer local programs for water resources and development as provided by law; establish and supervise regional water resources management commissions; cooperate with public and private agencies and receive funds from such agencies or the federal government; and administer all programs authorized by the legislature pursuant to the Natural Resources Bond Act. (Kahle-Fla)
W69-08824

DRAINAGE AND FLOOD CONTROL.
Ill Ann Stat ch 42, secs 472, 473, 481, 482 (Smith-Hurd Supp 1969).

Descriptors: *Illinois, *Flood control, *Administrative agencies, *Drainage, Legislation, Legal aspects, Water law, Water policy, Financing, Sewage disposal, Water utilization, Projects, Administration, Public health, Sewers, Drainage systems, Hydrographs, Drainage districts, Flood protection, Charts, Distribution patterns, Floods, Hydrograph analysis, Rainfall, Runoff, Mapping, Assessments.

The Department of Public Works and Buildings is responsible for making a survey and preparation of a master plan for drainage and flood control of all watershed areas of this state so that hazards to persons and property may be reduced. Such plan includes the full hydrography of each watershed area including rainfall, runoff, frequency and severity of floods. A drainage district may, when it finds that its drainage system is collecting sewage which is a menace to public health, construct a sewage disposal system to eliminate such sewage. Such a

system may be financed through assessments on the lands benefitted. Revenue bonds may be used to pay the initial costs of such construction, to be repaid solely from the revenue from the operation of such system. The Department is responsible for general coordination and supervision of the efforts of the individual districts. It may also enter agreements with the federal and local governments for the formulation of plans, including funding, and for the construction, operation and maintenance of improvements for flood control, drainage and utilization of water and water resources. (Johnson-Fla)
W69-08825

SANITARY DISTRICTS OUTSIDE OF MUNICIPALITIES.
Ill Ann Stat ch 42, secs 418, 421, 433, 437, 438, 439 (Smith-Hurd 1956), as amended, (Supp 1969).

Descriptors: *Illinois, *Administrative agencies, *Environmental sanitation, *Sewage disposal, Water purification, Sanitary engineering, Water law, Legislation, Legal aspects, Water policy, Administration, Financing, Taxation, Dams, Public health, Sewage treatment, Planning, Sewers, Sewage, Water utilization, Water pollution, Water pollution control, Water quality control.
Identifiers: *Sanitary districts, Special assessments.

The board of trustees of any sanitary district is responsible for the collection and disposal of sewage within their area and must protect the water supplied to their inhabitants from contamination. They may use such conduits, pipes and pumps as are necessary to construct an adequate sewage system for this purpose. They must also treat and purify all sewage before allowing same to flow into any lake, river or other water course. While real and personal property may be taken for the district's corporate purposes, whether by purchase or condemnation, adequate compensation must be paid therefore either by gross sum or annual rental. The district's sewers may pass along or under public roads or public ground and may have conduits and pipes laid under public waters, but in either case not in such a manner as to impede normal use thereof. A district has the power to keep its water courses free from pollution and may construct dams and remove debris from same in the interests of public health. The board may finance costs of such a system either through general taxation or special assessment. (Johnson-Fla)
W69-08826

REND LAKE DAM AND RESERVOIR.

Ill Ann Stat ch 42, secs 410.11, 410.12 (Smith-Hurd Supp 1969).

Descriptors: *Illinois, *Financing, *Federal government, *Costs, Dams, Contracts, Legislation, Water law, Legal aspects, Administrative agencies, Administration, Repayment contracts, Benefits, Economics, Projects, Public benefits, Compensation, Cost allocation, Cost sharing, Water policy, United States, Dam construction, Operation and maintenance.

The Governor and the Rend Lake Conservancy District may give assurance to any agency of the United States Government for the performance of items of non-federal participation involved in the construction, operation, and maintenance of the Rend Lake Dam and Reservoir on the Big Muddy River. The Department of Public Works and Buildings enters into such contracts with agencies of the federal government as are necessary for the purpose of reimbursing the United States in accordance with the Federal Water Supply Act of 1958 for the construction costs and the annual operation and maintenance costs allocated to certain water-supply storage improvements provided, however, that costs shall be limited to the increased cost of the project which the United States Government incurs in providing features of construction, operation and maintenance that result in benefit to the people of Illinois. (Johnson-Fla)
W69-08827

SANITARY DISTRICTS.
Ill Ann Stat ch 42, secs 312, 317 (Smith-Hurd 1956), as amended (Supp 1969); secs 317a (Supp 1969).

Descriptors: *Illinois, *Sewage, *Administrative agencies, *Environmental sanitation, Legislation, Legal aspects, Water law, Dams, Financing, Public Health, Sanitary engineering, Sewage disposal, Sewage treatment, Wastes, Water purification, Regulation, Planning, Beds, Ownership of beds, Beds under water, Sewers, Cost allocation, Water utilization, Taxes, Water quality control.
Identifiers: Special assessments, Sanitary districts.

A sanitary district may construct and maintain its sewers, channels, ditches and drains along, across or under any highway, street or public ground of the state so long as public use of such property is not hampered. Districts may construct and maintain such conduits and pipes upon any of the lands of the state which are under public waters provided permission from the governor is obtained before so doing. The board of trustees of each district is responsible for the construction of necessary facilities within the district including drains, sewers, laterals and pumping stations which are financed by either general taxation or by a combination of general taxation and special assessments. When a district has constructed a sewage disposal plant, the board of trustees may build a dam or dams to regulate the flow of the waters of any stream or river if the public health would be improved thereby. The board may also take such action as is necessary to remove debris, refuse and other objectionable matter from any river within the district after the construction of a sewage disposal plant. (Johnson-Fla)
W69-08828

FISH RESTORATION AND MANAGEMENT PROJECTS.

Ill Ann Stat ch 56, secs 249-250 (Smith-Hurd 1967).

Descriptors: *Illinois, *Fish management, *Federal government, Fish establishment, Fish populations, Projects, Fish conservation, Administrative agencies, Administration, Fishing, Fisheries, Permits, Costs, Cost transfer, Legislation, Legal aspects, State governments, Federal project policy, Regulation.
Identifiers: *Fish restoration projects, Licenses.

Illinois hereby assents to the provisions of the federal statute entitled 'An act to provide that the United States shall aid the states in the fish restoration and management projects, and for other purposes.' The Illinois Department of Conservation is hereby authorized to perform acts necessary to the conduct and establishment of such projects in compliance with said act and rules and regulations promulgated by the Secretary of the Interior thereunder. Fishing license fees shall not be diverted for any other purpose than the administration of the Department of Conservation. (Carruthers-Fla)
W69-08829

FISH.

Ill Ann Stat ch 56, secs 243-247 (Smith-Hurd 1967), as amended, (Supp 1969).

Descriptors: *Illinois, *Fish harvest, *Fish management, *Minnows, Fish, Frogs, Turtles, Mussels, Shellfish, Transportation, Fishing gear, Bait, Commerical fish, Commercial fishing, Permits, Storage, Storage capacity, Storage tanks, Fishing, Sport fishing, Recreation, Legislation, Legal aspects, Judicial decisions, Regulation, Control, Administrative agencies.
Identifiers: Fish preserves, Restricted fishing areas, Licenses.

The Illinois Department of Agriculture has discretionary power and authority to set aside waters in the state as fish preserves in which it is unlawful to take fish, minnows, frogs, turtles or mussels except as hereinafter provided. The Department also has such discretionary authority to designate certain waters as restricted fishing areas in which it is unlawful to take fish with commercial devices during certain designated time periods. It is unlawful for any person to destroy or deface any notice or proclamation posted pursuant to this act. It is unlawful to receive for shipment fish or other marine life protected by this act unless there is presented a wholesale fish dealer's license. Detailed shipping restrictions are set forth. Specific regulations govern commercial minnow dealers and wholesale minnow dealers regarding shipment of minnows, various containers of minnows, license applications, and storage ponds for minnows. Specific regulations also govern retail minnow dealers. Minnows held in storage ponds can be sold at any time of the year but may not be transported beyond the state's borders. Any judicial decision holding a part of this act unconstitutional or invalid shall not affect validity of the remainder of the act. (Carruthers-Fla)
W69-08830

POWERS OF THE DEPARTMENT OF CONSERVATION.

Ill Ann Stat ch 127, secs 63a5, 63a15, 63a22 (Smith-Hurd 1967).

Descriptors: *Illinois, *Pollution abatement, *Water conservation, *Administrative agencies, Legislation, Water pollution control, State governments, Fishing, Recreation facilities, Parks, Boats, Rivers, Lakes, Streams, Regulation, Boating regulations, Legal aspects.

The Department of Conservation shall have the following powers: (1) to exercise all rights, powers, and duties conferred by law and to take such measures as are necessary for the prevention of pollution in rivers, lakes, streams, and other state waters; (2) to designate the size, type, and kind of boats that may be used on lakes owned and operated by the Department; and (3) the power to provide rowboats and other watercraft for daily rental at a reasonable fee at any of the state parks, public fishing areas or other properties of the Department where such boating facilities are considered feasible. (Heckerling-Fla)
W69-08831

POWERS OF THE DEPARTMENT OF CONSERVATION.
Ill Ann Stat ch 127, sec 63a 1 (Smith-Hurd 1967).

Descriptors: *Illinois, *Wildlife conservation, *Wildlife management, *Administrative agencies, Legislation, Frogs, Fish, Turtles, Wildlife, Conservation, Shellfish, State governments, Distribution, Preservation, Legal aspects.

The Department of Conservation shall have the power to take all measures necessary for the conservation, preservation, distribution, introduction, propogation, and restoration of fish, mussels, frogs, turtles, game, and other wild animals. (Heckerling-Fla)
W69-08832

SUSQUEHANNA RIVER BASIN COMPACT - WATER SUPPLY AND WATER QUALITY MANAGEMENT AND CONTROL.
MD Ann Code art 96A: 63, 64 (Supp 1968).

Descriptors: *Maryland, *Interstate commissions, *Water supply, *Water quality control, Interstate compacts, River basins, Legislation, New York, Pennsylvania, State governments, Water resources control, River basin commissions, Water management, Dams, Reservoirs, Storage, Surface water, Ground water, Water quality, Reservoir storage, Water pollution control, Water policy, Domestic

water, Industrial water, Dam construction, Regulation.
Identifiers: *Susquehanna River Basin Compact.

The Susquehanna River Basin Commission shall have the power to effectuate projects for the use of basin water for domestic, municipal, agriculture and industrial water supply. It may construct, acquire and operate dams, reservoirs and other structures to this end. The commission may provide for the storage and release of waters for the regulation of water flow to protect public health, stream quality control, pollution control, recreation, prevention of undue salinity and other purposes. All signatory parties shall cooperate in the storage and release operations. The commission may provide water management and regulation in the main stream or any tributary in the basin and may apply a beneficial assessment therefore to all water users. The commission shall not engage in the business of distributing water. The commission may undertake studies for water quality management and control and may acquire, construct and operate facilities for the management of water quality in the basin. It shall be the policy of the commission to encourage the elimination of water pollution and the establishment and enforcement of water quality standards. (Helwig-Fla)
W69-08845

EFFECT OF PUBLICITY ON VALUATION IN CONDEMNATION OF THE PROPOSED IMPROVEMENT,
Arizona State Highway Dept., Phoenix.
Stanley Z. Goodfarb.
Right Way, p 16-19, Apr 1969. 4 p.

Descriptors: *Condemnation, *Condemnation value, *Property values, *Real property, *Land appraisal, Effects, Legal aspects, Negotiations, *Eminent domain, *Judicial decisions, Jurisdiction, Projects, Land, *Right-of-way.
Identifiers: *Valuation, *Publicity, Land acquisitions, Effect.

The public announcement of a construction project often precedes construction by several years. The developer who moves in early to be adjacent to the improvement will often acquire his property before the public agency has acquired the land required to build the proposed improvement. As a result, often the public agency must purchase or condemn part of the land that the developer bought. The problem arising is that land values increase after the announcement of the planned improvement. The developer paid a higher price because of the proposed improvement, but the public agency often will offer him less than he paid for the property. Courts usually rule that the value of a property cannot be enhanced legally by reason of its proximity to the very project for which the property is being acquired. The rule also works in reverse so that properties cannot be depressed in value by the announcement of an unpopular or unattractive structure, such as a proposed sewer plant in an established neighborhood. The value of the property acquired must be measured at its value before the announcement of the proposed improvement. (USBR)
W69-08846

COMPREHENSIVE WATER POLLUTION CONTROL PROGRAM.
For primary bibliographic entry see Field 05G.
W69-08863

DRAINAGE DISTRICTS (1-7).

W Va Code Ann, sec 19-21-1 thru 19-21-41 (1966), as amended, (Supp 1968).

Descriptors: *West Virginia, *Drainage districts, *Jurisdiction, *Financing, Legislation, Water law, Legal aspects, Taxes, Eminent domain, Assessments, Administration, Construction, Cost-benefit ratio, Appraisals, Publications, Reviews, Administrative agencies, Costs, Bridge construction, Planning, Ditches, Operation and maintenance.

Drainage districts are to be organized under circuit court jurisdiction. Objections and appeals to the formation of districts are provided for. The act makes provisions for: owners' meetings; the election of a board of supervisors and the appointment of a chief engineer; and the funding of preliminary expenses. A board of appraisers is to be established for assessing the benefits to those property owners within the district. A jury assessment is to be available. The procedure for letting contracts is enumerated. The act provides for the annual levying of taxes and the method of collection. It indicates when the taxes are payable and outlines the procedure for collection of delinquent taxes. All bonds are considered liens on the district lands. The power to drain, protect and reclaim land is given to the board. The district shall have the power to eminent domain. Costs of bridge construction are to be borne by the district. Actions are not abated by the death of the parties. Procedures for formulating new plans, removing officers, connecting, maintaining, and preserving ditches and consolidating adjacent districts are outlined. A penalty is prescribed for obstructing drains. (Holt-Fla)
W69-08878

DRAINAGE DISTRICTS (1).
W Va Code Ann, sec 19-21-1 thru 19-21-5 (1966), as amended, (Supp 1968).

Descriptors: *West Virginia, *Drainage districts, *Jurisdiction, *Land reclamation, Public benefits, Public health, Legislation, Water law, Engineers estimates, Engineering personnel, Reclamation, Wetlands, Construction, Administrative agencies, Legal aspects, Cities, Flood control.

The circuit courts are conferred with the power to establish, organize and provide for the operation and maintenance of drainage, levee and reclamation districts. When organized the districts have the power to reclaim lands and construct such levees, ditches and canals as are necessary to carry out the purposes of the act. These purposes are to improve wetlands and to protect cities from overflow. All district projects must result in public benefits, promote the public health or be conducive to the general welfare of the community. Three or more owners of real property within a proposed district may petition the court to establish a drainage district. The petition must generally describe the lands to be reclaimed and the advantages that will result from the proposed improvement. After the petition is filed the court shall appoint a qualified engineer who must recommend the general improvements required, make an estimate of their costs and file a list of all property holders within the proposed district. Following the engineer's report the circuit clerk must publish a notice to the property owners that the petition has been filed. Procedures are outlined by which any landowner within the proposed district may object to its formation. (Holt-Fla)
W69-08879

DRAINAGE DISTRICTS (2).
W Va Code Ann, sec 19-21-6 thru 19-21-11 (1966), as amended, (Supp 1968).

Descriptors: *West Virginia, *Drainage districts, *Drainage programs, *Administration, Administrative costs, Legislation, Organizations, Water law, Land reclamation, Reclamation, Taxes, Tax rate, Financing, Supervisory control (Power), Surveys, Engineers estimates, Drainage engineering, Project planning, Costs.

Within 30 days after any drainage district is established the circuit clerk shall call a first meeting of the landowners for the purpose of electing a board of supervisors. Subsequent to the first meeting the board shall call annual meetings of the landowners to re-elect supervisors. The board of supervisors is required to annually report to the landowners any work that has been done in the district. A competent civil and drainage engineer shall be appointed by the supervisors within 30 days after organization of the district. His duties shall be to survey all lands within the district that may be improved or reclaimed and to submit a proposed plan for draining, leveeing, and reclaiming the lands described in the survey. If the board approves the plan it shall be designated as 'the plan for reclamation.' A tax of up to 50 cents per acre on all lands within the district shall be levied by the board to defray preliminary expenses. (Holt-Fla)
W69-08880

DRAINAGE DISTRICTS (3).
W Va Code Ann, sec 19-21-12 thru 19-21-16 (1966), as amended, (Supp 1968).

Descriptors: *West Virginia, *Reclamation, *Assessments, *Appraisals, Legislation, Water law, Administration, Drainage districts, Judicial decisions, Railroads, Right-of-way, Maintenance costs, Benefits, Damages, Condemnation, Administrative decisions, Compensation, Property values.

Upon acceptance of a plan for reclamation by the board of supervisors and the filing of it with the circuit court, 3 uninterested appraisers are to be appointed by the judge whose duties shall include the assessment of benefits and damages that may result from implementation of the plan. The chief engineer shall accompany and advise the appraisers. When assessing benefits on each parcel of land within the district due credit is to be given for any existing systems of reclamation. Railroads and rights-of-way shall be assessed according to the increased physical efficiency and decreased maintenance costs. Lands outside the district's boundaries that will be benefitted are to be assessed and reported to the court for possible inclusion within the district. Notice by publication of the appraisers' report is to be given. Interested parties may file exception to the appraisers' report with the court and a summary hearing shall be provided. Anyone aggrieved by an assessment may present his complaint to the circuit court. The court's findings may be appealed. Property owners not accepting the assessment by the appraisers are entitled to a jury assessment consistent with the proceedings for condemnation of rights-of-way by railroad, telegraph and telephone companies. (Holt-Fla)
W69-08881

DRAINAGE DISTRICTS (4).
W Va Ann, sec 19-21-17 thru 19-21-22 (1966), as amended, (Supp 1968).

Descriptors: *West Virginia, *Drainage districts, *Taxes, *Assessments, Reclamation, Legislation, Administrative decisions, Administration, Construction, Cost-benefit ratio, Contracts, Bids, Benefits, Adjudication procedure, Legal aspects, Financing.

The board of supervisors shall have the power to build and complete all works necessary to carry out the plan for reclamation. The board may let contracts for such works to the lowest bidder who shall give bond for the contract price. The board shall levy a tax on all lands assessed benefits sufficient to pay the cost of completion as shown in the plan for reclamation plus 10 per cent of such cost for emergencies. Such taxes shall constitute a preferred lien on the real property in the district. An annual installment of the total taxes shall be levied thereafter by the board. (Holt-Fla)
W69-08882

DRAINAGE DISTRICTS (5).
W Va Code Ann, sec 19-21-23 thru 19-21-28 (1966), as amended, (Supp 1968).

Descriptors: *West Virginia, *Drainage districts, *Administration, *Taxes, Legislation, Regulation, Assessments, Reclamation, Condemnation, Drains, Alteration of flow, Watercourses (Legal), Natural

streams, Construction, Appropriation, Financing, Budgeting, Compensation, Operation and maintenance.

All bonds issued by the board of supervisors of any drainage district constitute a lien on all lands assessed therein and the board must levy an annual tax as needed to retire the bonds. In order to effect the drainage, protection, and reclamation of the land within the district the board is empowered: (1) to alter drains and watercourses within and without the district; (2) to construct and maintain all necessary works within and without the district; (3) to remove any obstacles within or without the district; and (4) to hold, control and acquire any lands or property interests within or without the district. The right to condemn any land not acquired by the court upon the appraiser's report is given to the board. The board may employ an attorney to act for and advise them. The board may not enter or appropriate any land for works of the district until the price is paid the owner or in the hands of the circuit clerk. (Holt-Fla)
W69-08883

DRAINAGE DISTRICTS (6).
W Va Code Ann, secs 19-21-29 thru 19-21-34 (1966), as amended, (Supp 1968).

Descriptors: *West Virginia, *Drainage districts, *Construction costs, *Ditches, Railroads, Public utilities, Natural streams, Watercourses (Legal), Specification, Construction structures, Boundaries (Property), Boundary disputes, Reclamation, Legislation, Cost allocation, Administrative agencies, Legal aspects.

The cost of constructing any public ditch or drain across any public highway or the right-of-way of any railroad, tramway or other public utility shall be borne by the drainage district. If the ditch follows a natural watercourse and it becomes necessary to enlarge any structure upon said watercourse then such enlargement shall conform to the district's chief engineer's specifications and the expense shall be borne by the county, railroad, tramway or other public utility so involved. The cost of all necessary constructions where said construction does not follow a natural watercourse shall be borne by the district. The cost removing and replacing any structure to enable the passing of any dredge boat or other equipment shall be borne by the district. Specific procedures for the amendment of the plan of reclamation are set forth. Provisions are also included to enable any owner to object to such proposed amendments. (Holt-Fla)
W69-08884

DRAINAGE DISTRICTS (7).
W Va Code Ann secs 19-21-35 thru 19-21-41 (1966), as amended, (Supp 1968).

Descriptors: *West Virginia, *Drainage districts, *Administration, *Financing, Taxes, Drainage, Reclamation, Assessments, Obstruction to flow, Administrative decisions, Ditches, Watercourses (Legal), Legislation, Maintenance costs, Acreage, Legal aspects, Administrative agencies, Costs, Cost repayment.
Identifiers: Penalties (Criminal).

The board of supervisors of any drainage district may issue serial bonds not to exceed 90% of the unpaid taxes levied. Funds from the bonds shall be used to pay the cost of the drainage works and improvements. If the plan for reclamation is deemed inadequate the board may formulate new or amended plans and additional assessments may be made. All ditches and watercourses in existence prior to the inception of the plan for reclamation may be made a part of the works and improvements of the plan at the board's discretion. The circuit court, however, may review the board's discretion. A maintenance tax may be levied annually by the board upon completion of the improvements. Two or more adjacent districts may be united if a majority of the acreage voters approve a petition to unite. It shall be a misdemeanor to obstruct a drain or damage drainage works. (Holt-Fla)
W69-08885

A UNIFIED CABINET-LEVEL DEPARTMENT OF WATER DEVELOPMENT AND OPERATION HAVING FULLY COORDINATED FUNCTIONAL SERVICES TO MEET MODERN NEED,
Shu-t'ien Li.
For 8-Volume Proceedings See Vol 2, No 9, 06B W69-03305. Proc International Conference on Water for Peace, Vol 5, p 365-369, 1967.

Descriptors: *Water resources development, *Planning, *Administrative agencies, *Coordination, Social needs, Governments, Administration, Water policy, Inter-agency cooperation, Adoption of practices, Federal government, Management, Control, Water conservation.

The author proposes that a cabinet-level department of water development and operation be established to fully coordinate the functional services required to meet modern water needs. It is suggested that as a nation becomes more civilized, the more illogical and unstreamlined its governmental agencies for water development and operation become. The major services a cabinet-level department would provide would be: (1) national hydro-data; (2) national hydro-conservation; (3) national water supply; (4) national waste-water sanitation; (5) national reclamation and flood control; (6) national hydroelectric power; (7) waterways, harbors, and maritime administration; (8) water pollution control; (9) interstate water; (10) international cooperation; (11) water development financing; (12) water research and development; and (13) wet space. Under each of these services would be several bureaus handling segments of the services. (Heckerling-Fla)
W69-08886

EXECUTIVE LEADERSHIP AND COMMUNITY INNOVATION: THE FLUORIDATION EXPERIENCE,
State Univ. of New York, Buffalo; and Chicago Univ., Ill.
Donald B. Rosenthal, and Robert L. Crain.
Urban Affairs Quarterly Vol 1 (3), March 1966, 39-57.

Descriptors: *Decision-making, *Fluoridation.
Identifiers: City-Managers, Mayors, Public support.

Utilizing an approach to governmental decision-making which is different from most studies, the authors study the same issue in every case and report the relationship between the public position taken by the Mayor and the outcome of the decision in 362 cities. The author contends that the position taken by the Mayor is crucial in understanding the decision a community makes with respect to fluoridation. In turn, the Mayor is influenced by certain pressures operating in the community, but he is more than a mere pawn in the decision-making process. Mailed questionnaires were sent to local informants, the publisher of the largest local newspaper, the local health officer, and the city clerk in each of 1,186 cities. The central finding is that the position taken on fluoridation by the formal executive leadership (the Mayor or City-Manager) virtually determines the decisions made by the government; if the Mayor does not publicly support fluoridation, there is very little chance for its adoption. The data point out the importance of the Mayor as an important positive cue for voters and as a symbolic leader of the community. One of the factors which seems to play a major part in the City-Manager's stand is the extent of his professionalism, which may create attitudes more favorable toward innovation. The non-professional managers are equally (if not more) willing to support fluoridation when it is not controversial. The professional manager, however, is the main support of the 'cause' when it is controversial. This is consonant with the image of the manager as a man in touch with new developments effecting municipal government, and one more likely to have continuing contact with and respect for technical experts. (Fortinsky-Chicago)
W69-08891

DEVELOPMENTS IN THE UNITED NATIONS RELATING TO SEA-BED AND OCEAN FLOOR,
G. Haight.
Nat Resources Lawyer, Vol 11, No 2, p 119-130, May 1969, 12 p. 42 ref.

Descriptors: *United Nations, *International commissions, *International waters, Foreign countries, Water resources development, International law, Oceans, Continental shelf, Pollution, Beds, Beds under water, Mineralogy, Boundaries (Property), Resources, Legal aspects, Resource development.

The 23rd session of the General Assembly of the United Nations adopted four resolutions relating to resources of the ocean floor beyond the limits of present national jurisdiction. The first establishes a 42 nation committee, including the United States, to study the elaboration of principles to promote international cooperation in the use of these resources and to ensure that their exploitation will be for the benefit of all mankind. There is general agreement that precise boundaries need to be set beyond which no nation may lay claim by use, occupation, or otherwise, but there is much disagreement between developed and developing countries over the use of the resources. The developing countries are in favor of a 'common heritage' doctrine which would ensure that the resources would redound in considerable measure to their enrichment, that economic injury to them would be prevented, and that their interests would be accorded major consideration. The second resolution which deals with the pollution of those resources, passed without opposition. The third resolution requesting the Secretary General to study the establishment of 'appropriate international machinery' in regard to these resources was opposed by the developed countries as a step toward the 'common heritage' theory. The fourth resolution relates to an international Decade of Ocean exploration under the aegis of the United Nations. (Kahle-Flrida)
W69-08980

POLITICAL BEHAVIOR AND THE DECISION-MAKING PROCESS IN THE ALLOCATION OF WATER RESOURCES BETWEEN RECREATIONAL AND MUNICIPAL USE,
Clark Univ., Worcester, Mass.
Roger E. Kasperson.
Natural Resources Journal, Vol 9, No 2, p 176-211, Apr 1969. 36 p, 5 fig, 11 tab.

Descriptors: *Decision making, *Water resources, Political aspects, Management, Water supply, Legislation, Planning, Water allocation.
Identifiers: *Political behavior, *Water dispute, Recreational use, Municipal use, Awareness, Knowledge, Political behavior, Organization, Spatial linkage.

Recent research has substantially extended our understanding of the ways by which private individuals manage a particular natural resource. A concern with the degree of knowledge and accuracy of perception by the resource manager and the significance of such cognition for the decision-making process is a prominent attribute of these studies. At the same time, however, these research findings illustrate the key role which the political system plays in such questions in a modern, industrial state. The author contends that the specific issue of resource allocation and management are derivatives of more general problems of political economy. Nevertheless, a corresponding thrust of research into the interactions among individual resource users has not been forthcoming. By examination of one local political conflict over both the spatial and functional allocation of water resources, this study seeks (1) to present some ini-

tial finding on characteristics of attitudes and political behavior in a water resource dispute, and (2) to identify a number of larger issues in the public management of natural resources. (Loeb-Rutgers)
W69-08982

SOME NEW MACHINERY TO HELP DO THE JOB,
Wisconsin Univ., Madison, Wis.
Jacob H. Beuscher.
IN Environmental Quality in a Growing Economy, Baltimore, The Johns Hopkins Press, 1966. p 156-163, 8 p, 1 ref. Henry Jarrett, Editor.

Descriptors: *Federal government, *Conservation, *Water management, *Technology, Water pollution, Flood-plain, Streams, Pesticides, Watercourses, Water quality, Wetlands, Coasts, Inland waterways, Wildlife, Fisheries.
Identifiers: *Residual sovereignty, *Regional government, *Environmental quality, State planning, Problem shed, Water disposal, Data, Shorelands, Externalities.

This article deals with the importance of compiling vast quantities of data about environmental quality in one place, and of keeping this information current. In addition, this data should be continuously analyzed, with a special interest toward discovering interrelationships. As far as the governmental participation in this process is concerned, joint boards could serve to carry out direct regulatory programs for improving environmental quality in interstate regions, until such time as interstate compacts could be made. State governments can serve as the agency to care for environmental problems in metropolitan regions that are unable to be handled by any regional unit. The state could be given bargaining status with private developers, in hopes of avoiding previous environmental problems. State level experiments can also be broadened to include federal/state relations, as well as state/state and state/local relations, with efficient improvement of environmental quality as the goal. Courts still should not be eliminated from their position in these problems, but not much should be expected from them. This article is of interest to water researchers, due to the use of water problems as examples in governmental actions. (Murphy-Rutgers)
W69-08984

POLITICAL ENVIRONMENT OF WATER RESOURCES,
Cornell Univ., Ithaca, N.Y.
Leonard B. Dworsky.
IN The Fresh Water of New York State: Its Conservation and Use, p 21-28, Wm C. Brown Book Co, Dubuque, Iowa, 1967. 8 p, 1 disc. Lauren B. Hitchcock, Editor.

Descriptors: *Political aspects, *Water resources, Water shortage, New York, Administration, Water resources development, Waste treatment, Water pollution.
Identifiers: *Political environment, STATE Water Resources Commission, State water planning, Regional water planning, Federal water planning, Legislative committees.

New York State has made major strides in the past decade in water management. Political leadership has been sensitive to water problems. Change is creating new problems and the political environment must be responsible to them. The author contends that legislative committee staffs must be strengthened and executive agencies need to be more responsive to problem identification. State water resources planning needs to keep pace with rapid changes in regional and federal water resources planning and development efforts. The multiplicity of local government water units has created barriers to effective regional development of limited water resources. These and other problems must be better managed if political factors are not to impede future programs. The frame of reference suggested to guide future policies in these and related questions are the basic purposes guilding the US Advisory Commission on Intergovernmental Relations in its efforts to strengthen the federal system. (Loeb-Rutgers)
W69-08988

TRANSACTION COSTS, RESOURCE ALLOCATION AND LIABILITY RULES--A COMMENT,
Yale Univ., New Haven, Conn.
Guido Calabresi.
Jour of Law and Ecom. Vol XI, p 67-73, April 1968. 8 p.

Descriptors: *Resource allocation, Joint costs, Welfare.
Identifiers: *Transaction costs, *Bargaining, Legal structures, Short run, Liability rules, Government intervention.

Professor Coase argued that (assuming no transaction costs) the same allocation of resources will come about regardless of which of two joint cost causers is initially charged with the cost, in other words regardless of liability rules. While the author believes this analysis is only correct for the short run, he does believe that it gives an admirable tool for suggesting what kind of empirical data would be useful in making resource allocation decisions and for indicating what kinds of guesses are likely to be justifiably made in the absence of convincing data. This analysis combined with common intuitions as to the relative costs of transactions, taxation, structural rules and liability rules can go far to explain various types of heretofore inadequately justified governmental actions. It can help us to delineate those areas of uncertainty where more facts would help us make better resource allocation judgments. This would also include judgments concerning the allocation of water resources. (Sokoloff-Rutgers)
W69-09000

FEDERAL AID FOR WATER POLLUTION CONTROL.
For primary bibliographic entry see Field 05G.
W69-09013

DELAWARE RIVER BASIN COMPACT.

Del Code Ann tit 7, sec 6501 (Supp 1966).

Descriptors: *Interstate commissions, *River basin development, *Interstate compacts, *Water utilization, Flood control, Flood plains, Hydroelectric power, Hydroelectric plants, Recreation, Water allocation (Policy), Water conservation, Water distribution (Applied), Water permits, Water resources development, Watershed management, Water shortage, Withdrawal, Pollution abatement, Interstate rivers, Project planning.
Identifiers: *Delaware River basin, INCODEL.

The Delaware River Basin Compact between Delaware, New Jersey, New York, Pennsylvania and the federal government sets up an interstate commission (INCODEL) to replace the numerous state and federal agencies previously exercising control over the basin. Each signatory party has one member on the commission, each with one vote. The commission has very broad powers to effectuate a comprehensive plan for development and use of basin resources on its own initiative, plus ultimate approval of all federal, state, municipal and private programs affecting these resources. All projects are to follow a comprehensive plan developed by the commission, supplemented by a more detailed water resources program. Specific areas of concern include development of water uses, pollution control, flood protection, watershed management, development of recreation and hydroelectric power, and regulation of withdrawals and diversions of water. Projects are financed by the parties according to benefits accrued from specific projects, by equitable apportionment among the parties, and by tax-exempt public bond programs. (Douberley-Fla)
W69-09015

ADMINISTRATION OF INTERNATIONAL RIVERS,
Wisconsin Univ., Madison.
I. K. Fox, Hans Gotzman, S. C. Smith, and T. U. Torti.
Paper presented at the United Nations Panel of Experts on Legal and Institutional Implications of Intern. Water Resources Development, December 9-14, 1968, Vienna, Austria, 47 p.

Descriptors: *Administrative agencies, Political aspects, Benefits, Treaties, Rivers, *River basins, Flexible foundations.
Identifiers: National interests.

This paper postulates a set of basic principles which should govern the administration of international river basin programs on the basis of a preliminary evaluation of experience in several different areas of the world. Five premises underlie the analysis: (a) National self-interest will have a powerful influence on the kind of administrative arrangements that are practicable; (b) Each nation will wish to weigh the consequences to it of alternative programs; (c) The full range of relations among the nations involved will influence the response of each nation; (d) The configuration of power and influence within a country will determine the kind of program that country will find acceptable; (e) The rapidity of technological change places a premium upon flexible arrangements. Seven principles emerge from the analysis: (a) Each participating nation must assess opportunities for realizing benefits through independent action; (b) Basic data for joint programs should be cooperatively developed; (c) The evaluation of benefits and costs of alternative joint plans must be undertaken by each nation individually; (d) Administrative arrangements should minimize opportunities for friction or disagreement in program implementation; (e) Administrative arrangements must assure faithful adherence to the agreed-upon program; (f) International treaties should emphasize basic principles rather than program details so as to facilitate changes when needed; (g) Initial agreements should make provision for joint consideration of possible changes as needed in the future. (Fox-Wis)
W69-09024

SOME POLITICAL ASPECTS OF LARGE SCALE INTER-BASIN TRANSFERS,
Wisconsin Univ., Madison.
For primary bibliographic entry see Field 06C.
W69-09025

6F. Nonstructural Alternatives

EVALUATION OF FLOOD PLAIN DELINEATIONS BASED ON SOIL MAPS IN THE TURTLE CREEK AND KICKAPOO RIVER WATERSHEDS, WISCONSIN,
Wisconsin Univ., Madison.
Robert M. Viaene.
Univ of Wisconsin Water Resources Center Report, 1969. 97 p. OWRR Project B-002-Wis.

Descriptors: *Flood plains, *Wisconsin, *Watersheds (Basins).
Identifiers: *Turtle Creek (Wis), *Kickapoo River (Wis), *Alluvial soils.

Results of these studies show that the boundaries of alluvial soils coincide most closely with the boundaries of rate floods, as determined by engineering methods, in older, dissected landscapes having well developed flood plains. In order to accurately delineate flood plains from soil maps in most areas, it is necessary to know which soils besides the alluvial soils are subject to flooding. An understanding of the geomorphic basis for the distribution of soils is essential. Stream gradient, land use patterns and the presence or lack of structures must be considered. The approach should be imaginative and interdisciplinary. An understanding of the limitations of different kinds of soil maps and their usefulness for flood plain mapping is also necessary so as to be able to choose the kind of additional infor-

mation that will be needed in particular areas. The use of other information to improve the reliability of soil interpretation does not reduce the value of soil maps for this purpose. Of the sources at hand in most places, soil maps depict the landscape from the broadest interdisciplinary approach. (Lee-Wis)
W69-09008

AN ACTIVITY ANALYSIS OF NON-STRUCTURAL FLOOD PLAIN MANAGEMENT ALTERNATIVES,
Wisconsin Univ., Madison.
John C. Day.
Univ of Wisconsin Water Resources Center Report, 1969. 121 p. OWRR Project B-002-Wis.

Descriptors: *Economic analysis, *Floods, *Nonstructural, Cost-benefit.

This report deals with the economic evaluation of non-structural measures for control of urban flood damages. The research objective was to explore the feasibility of certain quantitative techniques for the economic analysis of spatial land use of flood proofing. A simple linear programming model was developed for residential development in a presently vacant flood plain area. The analytical approach was tested using a small community in a 'demonstration study' framework. Data sources and limitations are discussed. The success of the approach in identifying an economically efficient land use planning response to flood problems is encouraging and indicates that further research is likely to be fruitful. (Author)
W69-09009

THE USE OF SOIL MAPS IN THE DELINEATION OF FLOOD PLAINS,
Wisconsin Univ., Madison.
John M. Cain, and Marvin T. Beatty.
Water Resources Research, Vol. 4, No. 1, February 1968, p 173-182, 9 p, 5 fig, 21 ref. OWRR Proj B-002 Wis.

Descriptors: *Wisconsin, *Mississippi River, Flood plains, River basins, Morphology.
Identifiers: *Soil maps, *Flood plain delineation, Southwestern Wisconsin, Morphology, Alluvial soils.

Soil maps provide a tool for rapid, low-cost delineation of river flood plains, based on the difference in morphology between soils frequently flooded and soils free of flooding. Very rare floods along the Mississippi River inundated over 99 percent of the soils that would be expected to flood but in addition flooded 7 percent of the terrace soils. Flooding predicted with soils information was compared with flooding predicted with an engineering study for small streams in a mature landscape in southwestern Wisconsin. For a 100-year synthetic flood an agreement of plus or minus 4.5 percent was obtained. Comparison of flooding with soil types for a small stream in a recently glaciated landscape in southeastern Wisconsin indicated that alluvial soils flood frequently and, in addition, that soils with restricted drainage and soils of fluvial origin also flood frequently. Some of the data are inconclusive, owing to the lack of precise flooding information to serve as a basis of comparison. In areas where man made works do not appreciably alter the stream regimen and where extensive flood plain areas must be delineated, it appears that accurate soil maps, properly interpreted, will give a good estimate of areas subject to flooding. (Cain-Wis)
W69-09017

07. RESOURCES DATA

7A. Network Design

STATISTICAL METHOD OF DETERMINING THE OPTIMUM NUMBER OF MEASUREMENTS OF STREAMFLOW CHARACTERISTICS,
State Hydrological Inst., Leningrad (USSR).
M. L. Ruppert.
Soviet Hydrol: Selec Pap, Issue No 2, p 115-123, 1968. 9 p, 1 fig, 3 tab, 9 ref. Trans Trudy Gos Gidrol Inst, No 150, p 17-28, 1968.

Descriptors: *Hydrologic data, *Statistical methods, *Surveys, *Sampling, Statistics, Estimating, Probability, Variability.
Identifiers: *USSR, Data requirements, Streamflow characteristics.

The theory of random variables is used to solve the problem of determining the amount of data necessary for hydrologic studies. Most hydrologic phenomena are the result of so many poorly understood natural factors that they may be regarded as random functions. Calculation of data requirements is based on determination of the probable error in the average value of a series as a function of the coefficient of variation and the number of measurements. (Knapp-USGS)
W69-08728

PROBLEMS OF NETWORK DISTRIBUTION AND EVALUATION OF THE METHODS BEST SUITED FOR HYDROMETRIC INVESTIGATIONS (RUSSIAN),
State Hydrological Inst., Leningrad (USSR).
I. F. Karasev, A. M. Gavrilov, P. A. Shestakova, K. S. Kabanova, and A. V. Savel'yeva.
Trudy Gos Gidrol Inst No 164, 1968. 164 p, 36 fig, 19 tab, 129 ref.

Descriptors: *Hydrometry, *Network design, *Mathematical studies, *Methodology, Irrigation districts, Drainage engineering, River basins, Statistical methods, Discharge (Water), Correlation analysis, Hydroelectric plants, Turbulent flow, Slopes, Winds, Velocity.
Identifiers: *USSR, Hydrometric methods evaluation.

A collection of 12 papers is presented that discuss distribution of hydrologic networks and the analysis of methods best suited for hydrological studies. Principles for the development of networks is discussed by N. F. Karasev. Distribution of hydrological networks in areas of large hydro-electric stations by A. M. Gavrilov, and principles of distribution of data stations by R. A. Shestakova are the basis of two papers. Networks in irrigated and drainage areas are discussed. Statistical basis for the density of hydrological networks in the Oka River basin is presented. M. L. Ruppert discusses the analysis of discharge curves using a correlation method. A variation-statistical study of the structure of turbulent flow in open channels is presented by I. F. Karasev. Other papers present information on measurement of water surface slopes where there are no flood plains, wind effects on coefficient of transition from surface to mean velocity, and laws governing velocity pulsations in conduits for hydro-power stations. (Gabriel-USGS)
W69-08734

URBAN WATER RESOURCES RESEARCH,
American Society of Civil Engineers, New York. Urban Hydrology Research Council.
For primary bibliographic entry see Field 04C.
W69-08743

OBJECTIVE ASSESSMENT OF ADEQUATE NUMBERS OF RAINGAUGES FOR ESTIMATING AREAL RAINFALL DEPTHS,
British Meteorological Office, Bracknell (England).
For primary bibliographic entry see Field 02B.
W69-08928

THE EFFECTS OF DENSITY OF RECORDING RAIN GAUGE NETWORKS ON THE DESCRIPTION OF PRECIPITATION PATTERNS,
California Univ., Davis. Dept. of Water Science and Engineering.
For primary bibliographic entry see Field 02A.
W69-08931

RAINFALL INPUT FOR HYDROLOGIC MODELS,
Agricultural Research Service, Beltsville, Md. Hydrograph Lab.
For primary bibliographic entry see Field 02A.
W69-08932

7B. Data Acquisition

COMPUTER PROGRAM FOR CONVERTING NEUTRON PROBE READINGS TO SOIL WATER EQUIVALENTS,
Forest Service (USDA), New Orleans, La. Southern Forest Experiment Station.
T. W. Popham, and S. J. Ursic.
Soil Sci 1969, 107 (4): 302.

Descriptors: *Computer programs, *Nuclear moisture meters, *Data processing, Instrumentation, Moisture meters, Nuclear meters, Soil moisure meters, Moisture content, Soil moisture.

A program written in FORTRAN IV computes water equivalents by one of three methods: (a) Water equivalent= Depth increment (percent water by volume); (b) Water equivalent= Depth increment (A+ B (probe count)+ C (probe count 2)); (c) Water equivalent= Depth increment (A+ B probe count/shield count+ C (probe count/shield count)2) where: A= Y intercept of calibration equation; B= linear coefficient of calibration equation; and C= quadratic coefficient (when calibration equation is linear the quadratic coefficient is zero). (Author)
W69-08639

IMPROVED STANDARDS FOR NEUTRON SOIL WATER METERS,
Forest Service (USDA), Oxford, Miss. Southern Forest Experiment Station.
S. J. Ursic.
Soil Sci 1967, 104 (5): 323-325.

Descriptors: *Nuclear moisture meters, *Calibrations, *Instrumentation, Moisture meters, Nuclear meters, Soil moisture meters, Moisture content, Soil moisture, Mississippi.

Economical standards made from polyethylene cylinders 2.5 to 4.5 inches in diameter proved highly satisfactory for operational checks and recalibrations of neutron soil water probe systems. (Author)
W69-08640

USING RUNOFF EVENTS TO CALIBRATE SMALL FORESTED CATCHMENTS,
Forest Service (USDA), Oxford, Miss. Southern Forest Experiment Station.
S. J. Ursic, and T. W. Popham.
In 14th Congr Proc, Int Union Forest Res Organ 1: 319-324, 1967. (Munich, Germany).

Descriptors: *Calibrations, *Rainfall-runoff relationships, *Statistical methods, *Storm runoff, Water measurement, Mathematical models, Watershed management, Hydrologic aspects, Mississippi.
Identifiers: *Experimental watersheds, *Hydrologic analysis.

Calibration and analysis based on individual runoff events appear efficient for evaluating changes in the hydrologic performance of small paired catchments. The approach is particularly useful where effects of watershed treatment on changes in ephemeral flow phenomena are of primary concern. (Author)

W69-08641

MULTIVARIATE METHODS USEFUL IN HYDROLOGY,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
Raymond M. Rice.
International Hydrology Symposium, Ft Collins, p 471-478, Sept 1967.

Descriptors: *Statistical models, *Correlation analysis, Demonstration watersheds, Soil erosion, Land clearing, Brush control, Grasses, Drainage systems, Soils, Geology, Hydrograph analysis, Analytical techniques, Mathematical studies.
Identifiers: *Multivariate statistics, Factor analysis, Cannonical correlation, Principal components, Brush conversion.

Multivariate statistical methods exist which are analogous to most of the univariate tests used in hydrology. In multivariate statistics, each individual can be described by multiple measurements thereby freeing the hydrologist from the need to describe a phenomenon by single number. Multivariate methods can estimate the probability of group membership based on such multiple measurements, test the equivalence of multidimensional samples, assess the position of a multiple measurement observation with respect to two or more populations known to be different, estimate the minimum number of underlying factors present in a larger set of correlated measurable variables and measure the correlation between two sets of variables or predict one set from the other. Multivariate techniques can be useful merely as ways of analyzing the dependence among sets of variates or, if the data are multivariate normally distributed, they can statistically test hypotheses concerning multidimensional samples. They allow for a flexibility of approach which is more in harmony with the nature of many hydrologic problems. Hydrologists should use these techniques when appropriate so they may benefit from the advantages of multivariate statistical methods. (Author)
W69-08661

A NEW 'SPHINCTER' CORER WITH A RECOILLESS PISTON,
SACLANT ASW Research Centre, La Spezia (Italy).
A. Kermabon, and U. Cortis.
Marine Geol, Vol 7, No 2, p 147-159, Apr 1969. 13 p, 7 fig, 3 ref, 2 append.

Descriptors: *Sampling, *Sediments, *Cores, *Equipment, Mechanical equipment, Design data, Research and development, Specification.
Identifiers: *Sphincter corers, Piston corer.

The 'Sphincter' corer developed by Kermabon et al was intended as an improvement over most of the existing piston corers. It included the following two original features: (a) A 'Sphincter-type' nylon core catcher, which seals the cores within a watertight container during retrieval; (b) A split piston, which prevents suction of the core when the corer is retrieved from the sediments. However, this corer had the defect inherent to all heavy piston corers that after release the piston does not remain stationary. A simple system of monitoring the piston relatively to a fixed platform lying on the sea floor is described. The device involves only cables and thin pulleys and can be installed on any existing 'Sphincter' corer. The equipment operates successfully and little or no disturbance can be observed in the cores. (Knapp-USGS)
W69-08696

FIELD USE OF ORIFICE METERS,
Geological Survey, Huron, S. Dak.
For primary bibliographic entry see Field 02F.
W69-08702

ESTIMATE OF THE RELIABILITY OF THE CHARACTERISTICS OF THE SHORTAGE IN SOLID PRECIPITATION DUE TO WIND,
Main Geophysical Observatory, Leningrad (USSR).
E. G. Bogdanova.
Soviet Hydrol: Selec Pap, Issue No 2, p 139-147, 1968. 9 p, 3 fig, 5 tab, 11 ref.

Descriptors: *Precipitation gages, *Snow, *Claibrations, Winds, Precipitation (Atmospheric), Snow surveys, Snowfall, Reliability.
Identifiers: *USSR, Snow gage corrections.

Sources of error in snow gaging are examined and a mathematical description of snow-catch by various gage types is given. Relationships are presented for calculating wind effect on snow gaging. Forests do not have sufficient aerodynamic effect on snowfall to require correction of snow survey data for clearings compared with the surrounding forest. Uncorrected gages in windy areas underestimate snowfall by as much as 100% or more. (Knapp-USGS)
W69-08725

THE CONSTRUCTION OF CALIBRATION CURVES FOR DETERMINING WATER CONTENT FROM RADIATION COUNTS,
East Malling Research Station, Maidstone (England).
For primary bibliographic entry see Field 02G.
W69-08756

THE APPLICATION OF GEOELECTRICAL METHODS TO GROUND-WATER EXPLORATION OF UNCONSOLIDATED METHODS TO GROUND-WATER EXPLORATION OF UNCONSOLIDATED FORMATIONS IN SEMI-ARID AREAS,
For primary bibliographic entry see Field 02F.
W69-08770

ACTIVATION ANALYSIS: A NEW TECHNIQUE FOR SOIL MOVEMENT STUDIES,
Iowa State Univ., Ames.
Craig E. Beer, and R. A. Hendrickson.
Agr Eng, Vol 50, No 3, p 144-145, Mar 1969. 2 p, 1 fig.

Descriptors: Soils, *Radioisotopes, *Tracers, *Sediment transport, *Isotopes, Movement, Gamma rays, Irradiation, *Sediment distribution, Laboratory tests, Hydrologic cycle, Hydrology.
Identifiers: *Activation analysis, *Lanthanum.

Laboratory test results show that lanthanum used as a tracer element in activation analysis permits detailed study of elements within a hydrologic cycle. In activation analysis, certain elements are irradiated with nuclear particles to produce radioisotopes. By counting the rate of disintegration of these radioisotopes, a quantitative evaluation of the amount of the original element present is possible. A soil-lanthanum test sample mixture was irradiated with thermal neutrons. Analysis showed that over 90% of the lanthanum adhered to the soil. The ultimate objective is to use lanthanum as a tracer element in activation analysis to study the origin and movement of sediments in certain phases of the hydrologic cycle. The procedure will involve mixing lanthanum in soil on a larger scale to produce a seeding batch. The treated soil will then be placed in the field at predetermined points. Sampling will be done immediately after seeding and at points along the flow path. The apparent ability of lanthanum to adhere to inert particles can make its use virtually unlimited. (USBR)
W69-08835

NUCLEAR LOGGING METHODS,
Mobil Research and Development Corp., Dallas, Tex.
Richard L. Caldwell.
Isotop Radiat Technol, Vol 6, No 3, p 257-273, 1969. 17 p, 15 fig, 2 tab, 18 ref.

Descriptors: *Logging (Recording), Borehole geophysics, Radioisotopes, Engineering geology, Gamma rays, Bibliographies, *Geophysics, Geologic investigations, Porosity, Oil-water interfaces, Nuclear meters, Rock properties, Radioactivity techniques, *Radioactive well logging, Rocks, Density, Minerals, Spectrum analysis, Photoactivation, Sediments.
Identifiers: *Gamma-gamma logging, Gamma probes, *Geophysical logging, *Well logging, *Nuclear density meters, *Nuclear probes.

New developments in nuclear logging methods are surveyed, placing emphasis on industrial uses. The discussion includes: (1) natural gamma logs for giving rock lithology, (2) gamma ray scattering for density and for locating concentrations of heavy elements in rocks, (3) neutron logs for porosity determination and oil-salt water differentiation, and (4) combinations of logs for identifying rocks and nonmetallic mineral deposits. Future nuclear logging methods are suggested for lunar and planetary surface analysis, ocean-bottom sediment-density gaging, and photo-nuclear activation of geologic samples. Computer methods are discussed for analyzing complex gamma spectra. (USBR)
W69-08841

AERIAL PHOTOGRAPHY,
Carl H. Strandberg.
Photogr Appl, Vol 2, No 8, 9, 10, p 25-30, 41-47, 23-43, Fall-Winter, Mar 1968-69. 21 p, 31 fig.

Descriptors: *Aerial photography, *Photogrammetry, Remote sensing, Photography, *Photographic equipment, Mapping, Measuring instruments, Water pollution, Photographs, Water pollution control, Optics, Optical instruments.
Identifiers: *Photointerpretation, Photomaps, Optimum crop yield, Resolution, Water pollution surveillance system.

Any photograph obtained from the air may be called an aerial photograph, but modern terminology frequently restricts this term to precise, high resolution photographs obtained from extreme altitudes. The first of this 3-part series is an introduction to aerial photography, including techniques and equipment. Some basic advantages of aerial photography are: location of the vantage point, resolution far superior to the unaided human eye, perception outside the visible spectrum, permanency, and geometric fidelity. The second part covers the state of the art of viewing equipment technology, projection interpretation, stereo projection, electronic viewing systems, application of filtering and multiband techniques in picture taking, and photogrammetric mapping. Two nonmilitary applications of photointerpretation and photogrammetry that may have a profound impact on our civilization are discussed. These applications are providing assistance in feeding the world's hungry millions and in the field of human health, particularly water pollution. (USBR)
W69-08859

TRACER DYNAMICS IN LAMINAR FLOW THROUGH POROUS MEDIA (ROMANIAN),
Academia R. P. R., Bucharest. Institutul de Fizica Atomica.
For primary bibliographic entry see Field 02F.
W69-08901

BIBLIOGRAPHY OF REMOTE SENSING OF EARTH RESOURCES FOR HYDROLOGICAL APPLICATIONS,
Geological Survey, Washington, D.C. Water Resources Div.
Rita K. Llaverias.
Geol Surv Open-file Rep, Sept 1968. 73 p, 4 ref. NASA-TM-X-61717.

Descriptors: *Bibliographies, *Documentation, *Remote sensing, *Hydrologic aspects, *Application methods, Earth (Planet), Aerial sensing, Cameras, Infrared radiation, Photography, Satellites (Artificial), Application equipment, Appraisals, Mapping, Methodology.

Identifiers: *Basic literature, *Earth resources, NASA.

This preliminary bibliography was prepared to acquaint hydrologists with the basic literature involved in this field. Some of the references concern specific hydrologic topics or specific remote sensing methods. Other references on vegetation mapping and geology were included so that the reader can find information on the selection, processing, and use of remote sensing data in these cognate fields. A number of meteorological references were included because in many remote sensing applications, especially from earth orbital satellites, atmospheric effects must be taken into account in interpreting the views of the earth. (Laverias-USGS)
W69-08902

LIQUID LEVEL DETECTION WITH SOLID STATE DEVICES,
Connecticut Univ., Storrs. Dept. of Agricultural Engineering; and Pennsylvania State Univ., University Park.
R. P. Prince, and G. W. Hawkins, Jr.
Proc Annu Meeting Amer Soc Agr Eng, June 22-25, 1969. Purdue Univ, Pap No 69-359, 1969. 6 p, 3 fig, 2 tab.

Descriptors: *Flowmeters, *Water levels, *Water measurement, *Instrumentation, Open channel flow, Closed conduit flow, Stage-discharge relations.
Identifiers: Water-level recorder.

A liquid level sensor using a series of water-shorted electrodes as a step-function generator is described. The design of a probe and associated solid-state electronic equipment is given. Flow histories and total flow volumes may easily be calculated by connecting the device to a chart recorder and calibrating the system for stage-discharge relations. (Knapp-USGS)
W69-08904

RADIOACTIVE TRACERS IN HYDROLOGICAL RESEARCHES IN USSR,
Moscow State Univ. (USSR).
For primary bibliographic entry see Field 02E.
W69-08913

7C. Evaluation, Processing and Publication

METHODS OF ESTIMATING MAXIMUM DISCHARGE OF GIVEN PROBABILITY,
Ministry of Melioration and Water Resources Management (USSR).
For primary bibliographic entry see Field 02E.
W69-08724

PROBLEMS OF NETWORK DISTRIBUTION AND EVALUATION OF THE METHODS BEST SUITED FOR HYDROMETRIC INVESTIGATIONS (RUSSIAN),
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 07A.
W69-08734

OPTIMIZING CONJUNCTIVE USE OF GROUNDWATER AND SURFACE WATER,
Utah State Univ., Logan. Dept. of Civil Engineering.
For primary bibliographic entry see Field 06A.
W69-08742

STIFF DIAGRAMS OF WATER-QUALITY DATA PROGRAMMED FOR THE DIGITAL COMPUTER,
Geological Survey, Lawrence, Kans. Water Resources Div.
Charles O. Morgan, and Jesse M. McNellis.
Kans State Geol Surv Spec Distribution Publication No 43, 1969. 27 p, 3 fig, 1 tab, 3 ref, 4 append.

Descriptors: *Computer programs, *Data processing, *Hydrologic data, *Water quality, *Kansas, Water chemistry, Aqueous solutions, Water analysis, Chemical analysis.
Identifiers: *Stiff diagrams.

Stiff diagrams, pattern diagrams used in interpretation of quality-of-water data, are calculated and printed with the aid of GE 625 digital computer at the rate of approximately 170 per minute. A range of scales for the diagrams is specified for each group of data. Each complete analysis is diagrammed if the cations and anions balance within 2, 3, or 5%, depending upon the amount of dissolved solids. (Knapp-USGS)
W69-08748

FORTRAN IV PROGRAM FOR SYNTHESIS AND PLOTTING OF WATER-QUALITY DATA,
Geological Survey, St. Paul, Minn.; and Geological Survey, Lawrence, Kans. Water Resources Div.
Leverett H. Ropes, Charles O. Morgan, and Jesse M. McNellis.
Kans State Geol Surv Spec Distribution Publication No 39, 1969. 59 p, 8 fig, 1 tab.

Descriptors: *Computer programs, *Water quality, *Data processing, Hydrologic data, Chemical analysis, Water chemistry, Digital computers, Analytical techniques.
Identifiers: Water quality data processing, Data plotting.

A FORTRAN IV program synthesizes data from the U.S. Geological Survey's water-quality cards. Line-printer output consists of tables and 2 semilog graphs in which the distribution and the minimum, mean, and maximum values of selected group of data are given. The 2 graphs represent front and top orthographic projections of a 3-dimensional array of data. The user selects (1) up to 16 variables, (2) data sorting according to multiple criteria such as aquifer and ranges of values of selected variables, (3) ion concentration units, (4) order of plotting, (5) log scale of the graphs, and (6) option of top-view graph. The program is operational on the GE 635 computer at The University of Kansas Computation Center (program designation: ROPES) and the U.S. Geological Survey's IBM 360/65 program library disc (program designation: DO160). (Knapp-USGS)
W69-08749

MODIFIED PIPER DIAGRAMS BY THE DIGITAL COMPUTER,
Geological Survey, Lawrence, Kans. Water Resources Div.
Jesse M. McNellis, and Charles O. Morgan.
Kans State Geol Surv Spec Distribution Publication No 45, 1969. 36 p, 2 fig, 1 tab, 9 ref, 3 append.

Descriptors: *Computer programs, *Data processing, *Hydrologic data, *Water quality, *Kansas, Water chemistry, Aqueous solutions, Water analysis, Chemical analysis, Digital computers.
Identifiers: *Piper diagrams.

Piper diagrams, used as aids in interpreting quality-of-water data, are produced accurately and efficiently by a digital computer. The computer produces the 2 triangular cation and anion diagrams and a square-grid modification of the original diamond-shaped diagram. Seven diagrams comprise the output from a quality-of-water data group. Three diagrams are square and the points plotted represent program-assigned sample identification numbers, aquifer identification numbers, and average position by aquifer number, respectively. Four diagrams are triangles to include cation and anion representations with sample and aquifer identification numbers. (Knapp-USGS)
W69-08750

ON THE USE OF POWER FLOW MODELS FOR SYSTEM PLANNING AND OPERATIONS,
Bonneville Power Administration, Portland, Oreg.; and Wolf Management Services, Palo Alto, Calif.
William F. Tinney, and John Peschon.
Pap, Thirty-first Annu Amer Power Conf, Chicago, Ill, Apr 1969. 13 p, 3 fig, 2 tab, 20 ref.

Descriptors: *Power system operations, *Electrical studies, Computers, Models, *Mathematical analysis, *Optimum development plans, Planning, Electric power production, Transmission (Electrical), Electrical networks, Electric power demand, Forecasting, Reliability, Economics, Bibliographies.
Identifiers: *Systems engineering, *Newton Method, Load flow, Cost savings, Power system stability, Optimum performance.

A description is given of recent research of new computer-based procedures for power system planning and operation. The most common approach consists of running as many power-flow studies as are believed necessary to ensure system security and economy. Until recently, power-flow computations for large systems were slow, unreliable, and costly. The introduction of Newton's Method with ordered triangular factorization and special programming techniques has greatly increased the efficiency of these programs. Much of this increased efficiency has been offset by the many trial and error runs performed for the sake of conscientiousness. Direct methods for analyzing the optimizing phases of power system operation and planning are introduced. The computer performs an organized and efficient search over a large number of alternatives and retains the optimum alternative. Direct methods can be formulated as problems of mathematical programming in which the power-flow equations enter as equality constraints. The power-flow model remains at the center of all power system computations being developed. (USBR)
W69-08869

DIGITAL COMPUTER SIMULATION IN HYDROLOGY,
Geological Survey, Menlo Park, Calif. Water Resources Div.
David R. Dawdy, and H. Terry.
Am Water Works Assoc Journ, Vol 59, No 6, p 685-688, Feb 1968. 4 p, 1 tab, 10 ref.

Descriptors: *Digital computers, *Computer models, *Hydrology, *Model studies, Hydrologic cycle, Runoff, Streamflow, Parametric hydrology, Measurement, Electronic equipment, Data processing, Optimization, Watersheds (Basins).

Computers make it possible to simulate in minutes the overall hydrologic cycle in much of its complexity, in contrast with one of the earliest models (Folse, 1929), which involved 41 people, took 16 years to complete, and consumed over 34,000 man hours. The U.S. Geological Survey is deeply involved in hydrologic modeling; examples presented are directed toward streamflow runoff and objective criteria for fitting the model to a particular basin. The results of three optimizing runs at Arroyo Seco near Pasadena, California, were tested. If parameters are insensitive, the fitted values may have little relation to true ones. A problem not yet investigated is the effect of errors in data upon the fitting process. If this valuable modeling tool is to be used to the best advantage, its weak points must be understood. (Affleck-Ariz)
W69-08893

08. ENGINEERING WORKS

8A. Structures

WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF ENGINEERS IN NEW JERSEY.
Corps of Engineers, New York. North Atlantic Div.

Corps Eng Water Resources Develop Rep, Jan 1, 1969. 68 p, 3 fig, 21 photo, 1 map, 3 tab.

Descriptors: *Water management (Applied), *New Jersey, *Water resources development, Navigation, River basin development, Flood control, Multiple-purpose projects, Hydroelectric power, Dams, River training.
Identifiers: US Army Corps of Engineers projects (NJ).

U.S. Army Corps of Engineers water resources development projects in New Jersey are listed. The role of the Corps of Engineers in planning and building water resources improvements is described briefly, and the procedures for initiating such studies, authorization procedures, and status of projects are outlined. Projects described include navigation, flood control, multiple-purpose projects, river surveys, erosion control, water supply, water pollution, power recreation, and flood plain studies. (Knapp-USGS)
W69-08710

WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF ENGINEERS IN ALASKA, 1969.
Corps of Engineers, Portland, Oreg. North Pacific Div.

Corps Eng Water Resources Develop Rep, Jan 1969. 29 p, 2 fig, 12 photo, 1 map.

Descriptors: *Water management (Applied), *Alaska, *Water resources development, Navigation, River basin development, Flood control, Multiple-purpose projects, Hydroelectric power, Dams, River training, Bank stabilization.
Identifiers: U S Army Corps of Engineers projects (Alas).

U.S. Army Corps of Engineers water resources development projects in Alaska are listed. The role of the Corps of Engineers in planning and building water resources improvements is described briefly, and the procedure for initiating such studies, authorization procedures, and status of projects are outlined. Projects described include navigation, flood control, multiple-purpose projects, river surveys, erosion control, water supply, water pollution, power, recreation, and flood plain studies. (Knapp-USGS)
W69-08718

LAY PIPE TO A BEAM OF LIGHT TO REDUCE COSTS AND INCREASE SPEED AND ACCURACY.

Amer City, Vol 83, No 10, p 105-110, Oct 1968. 3 p, 1 fig, 3 photo.

Descriptors: *Pipelines, *Sewers, *Laser, Concrete pipes, Clay pipes, Pipes, *Surveying instruments, Construction, Trenches, Surveying.
Identifiers: *Pipe laying, *Light beams, Cost savings, Accuracy.

A new laser system, used instead of conventional surveying procedures, will reduce costs and increase speed and accuracy when laying sewer pipe. The instrument emits a precise beam of red light to which the pipe is laid by means of a special reflex target on a calibrated storey pole. A rear reference beam aimed at a prismatic target that can be seen anywhere along the trench line provides an instant and continuous visual check on the alinement of the instrument. The instrument can be used above ground or in the trench. Compared to the conventional method of sewer construction, the laser system: (1) reduces stake-out and engineering time; (2) speeds construction because pipe can be laid closely behind the digging machine; (3) provides better accuracy because the beam of light does not sag and pipe can be laid to precise line and grade; and (4) reduces cave-ins, particularly in wet ground, because digging and laying pipe can be accomplished in one continuous operation. (USBR)
W69-08834

EDWARD HYATT POWERPLANT INTAKE STRUCTURE,
Parsons, Brinkerhoff, Quade and Douglas, N.Y.
Paul H. Gilbert.
Proc Amer Soc Civ Eng, J Power Div, Vol 95, No PO1, p 101-118, Mar 1969. 18 p, 18 fig, 7 ref, append.

Descriptors: Corrosion control, Corrosion, Hydroelectric plants, Water quality, Hydroelectric power, Environmental effects, *Intake structures, Environmental engineering, *Intake gates, *Intakes, Hydraulic machinery, Penstocks, Pumped storage, Stainless steel, Structural steel, Hydraulic gates, *Temperature control, Powerplants, Trash racks.
Identifiers: Corrosion resistance, Corrosion resistant alloys, *Oroville powerplant (Calif).

A major component of the 644-megawatt Oroville Powerplant on the Feather River in California is the sloping, multilevel, temperature-controlling intake structure. This intake is capable of providing the powerplant with over 16,500 cfs of water. The intake provides temperature control of water passing through the powerplant and downstream. Control is required to avoid damage to downstream agricultural, recreational, and fishlife interests. The intake can vary the temperature of the powerplant discharge by as much as 25 deg F. Submerged portions of the intake are designed for a pressure differential of 5 ft of head. The low design of 5 ft was made possible by utilizing special relief panels built into the intake system, limiting effects of overpressure to less than the 5-ft value. Stainless steel was used as a structural material for the trashrack system, the first such use in a major hydroelectric installation. Corrosion resistance of this material makes it ideally suited for use in an application involving a corrosive medium, inaccessibility, and strict structural requirements. In this case, using stainless steel was the most economical solution. (USBR)
W69-08836

VIBRATION ANALYSIS OF PUMP DISCHARGE LINES,
California State Dept. of Water Resources, Sacramento; and Development and Water Resources Corp., Sacramento, Calif.
Jesse M. Diaz, and Ravinder K. Jain.
Pap, Amer Soc Civ Eng Nat Meet Water Resour Eng, New Orleans, La, Feb 1969. 40 p, 6 fig, 1 tab, 16 graph, 6 ref, append.

Descriptors: *Discharge lines, *Pumps, Pumping plants, *Vibrations, Resonance, Pipelines, Natural frequency, Pressure, Kinetic energy, Velocity, Oscillation, Deflection, Analysis.
Identifiers: *Pipeline surges, *Stiffeners, *Vibration control, Amplitude, Propagation.

A method for determining the critical spacing for stiffener rings on exposed pump discharge lines under internal pressure is outlined. The analysis includes all parameters affecting the natural frequency of a discharge line. Using stiffener rings is not the only method of preventing vibrations in discharge lines, but is normally the most convenient for controlling or correcting vibrations in existing installations. Stiffener rings are assumed to act as simple supports that are free to rotate. This assumption is conservative and results in no great sacrifice to the economy of the project. Calculations made on the basis of a shell of infinite length whose bending stiffness is determined by the stiffeners acting with an effective length of the shell indicate the cross-section size of required stiffeners to be smaller than practical from a fabrication standpoint. Stiffeners rectangular in cross section that are large enough to satisfy fabrication requirements should be used, the minimum size being approximately 6 in. by 1/2 in. A criterion for avoiding resonant conditions in pipelines is given. (USBR)
W69-08838

HIGH ARCH DAMS IN THE WEST; MODERN TRENDS AND STATE OF THE ART,
International Engineering Co., Inc., San Francisco, Calif.
Gurmukh S. Sarkaria.
Pap, West Water Power Symp, ASCE, ASME, IEEE, p A-135-A-151, Apr 1968. 17 p, 9 fig, 1 tab, 9 ref.

Descriptors: *Arch dams, *Concrete dams, Concrete construction, Stress analysis, Concrete placing, Safety, Safety factors, *Dam design, Design criteria, Foundation investigations, Monoliths, Spillways, Underdrains, Geometric shapes, Engineering geology, Lifts (Construction), Mass concrete, Dam foundations, Aesthetics.
Identifiers: *Western United States, Double-curvature arch dams, Site selection, Design practices, Bullards Bar (Calif), Allowable stress.

Seven arch dams over 350 ft high have been built in the Western United States during the last 11 yr. Current trends indicate better utilization of wider and unsymmetrical sites, acceptance of higher stresses, and greater reliance on the inherent structural stability of an arch dam. A well-engineered arch dam with adequate foundation support, in comparison with other types, has substantially larger overall margins of safety against failure caused by structural rupture, leakage through the dam, and accidental or planned overtopping of either the fully or partially completed structure. Structurally, the arch represents the most economical and effective utilization of concrete and its strength properties to develop a safe dam. Recent emphasis on aesthetics of public facilities has enhanced prestige of the arch dam because it is unmatched for elegance, graceful lines, and beauty. Other factors that reflect present, and will influence future, arch dam engineering practices are the recognition of such advantages of this type of dam as simpler river diversion, safe overtopping during construction, shorter penstocks through the dam, and the possibility of storing water behind a partially complete dam. New Bullards Bar Dam in California is a typical example of current design and construction practices. (USBR)
W69-08865

8B. Hydraulics

ON THE REFLEXION OF WAVE CHARACTERISTICS FROM ROUGH SURFACES,
Oregon State Univ., Corvallis.
M. S. Longuet-Higgins.
J Fluid Mech, Vol 37, Part 2, p 231-250, June 23, 1969. 20 p, 12 fig, 10 ref. Supported by grant from NSF.

Descriptors: *Waves (Water), *Refraction (Water waves), *Roughness (Hydraulic), Energy, Frequency, Wavelengths, Mathematical studies, Viscosity, Turbulence, Shear, Mixing, Absorption.
Identifiers: *Water wave reflection.

The energy of internal waves tends to be propagated alon certain characteristic paths inclined at fixed angles to the vertical direction, depending only on the wave frequency and the density stratification, not on the wavelength. The role of surface roughness is examined. It appears that small-scale irregularities can completely alter the reflecting properties of a surface; the tangential scale of the roughness elements may be much smaller than the wavelength of the incident or reflected waves. All scales of roughness are relevant, down to those comparable in magnitude to the thickness of the oscillatory boundary layer. For tidal waves in the ocean this thickness is of the order of 1 m. The behavior of the coefficient of transmission as a function of the angle of incidence appears at first sight to be extremely complicated. Some simple examples of periodic surface roughnesses are discussed and elucidated: a sawtooth, a square-topped wave and a simple sine wave. An approximate expression is also derived in the case of a slowly modulated sine wave. These results are for a non-viscous fluid. The effects of

viscosity are also considered qualitatively. (Knapp-USGS)
W69-08717

SURFACE TENSION IN FROUDE MODELS,
Illinois Univ., Urbana.
W. Maxwell, Richard J. Weggel, and C. Hall.
Proc Amer Soc Civ Eng, J Hydraul Div, Vol 95, No HY2, p 677-701, Mar 1969. 25 p, 9 fig, 1 tab, 8 ref, 3 append.

Descriptors: *Froude number, *Surface tension, Fluid flow, Hydraulics, *Hydraulic models, Reynolds number, Viscosity, Spillways, Free surfaces, Weber number, Weirs, Vee-notched weirs, Rectangular weirs, Uniform flow, Experimental data, Energy equation.
Identifiers: Experimental models, Ogee crests, Bureau of Reclamation, Surface energy, Corps of Engineers.

A criterion for avoiding surface tension effects in Froude models is obtained analytically for uniform flows. Experiments show that surface tension does not limit the scale in curvilinear flow Froude models. In uniform flows, the least scale is determined by instrumentation accuracy and Froude number or by the need to exceed a limiting Reynolds number. The least scale is found by including a surface energy term in the energy equation or by considering the celerity of small free-surface disturbances. The scale is chosen so that experimental reading error scatter will mask any dependence on surface tension. Experiments on 3 weir geometries, for which flow at one head is interpreted as an imperfect Froude model of flow at a different head, are used to examine surface tension effects in Froude models of curvilinear flows. The viscosity was kept nearly constant and the surface tension varied using an additive. Variations caused by surface tensions are masked by the inherent scatter of data. (USBR)
W69-08851

SURGE STUDIES FOR PORTAGE MOUNTAIN TAILRACE SYSTEM,
Ingledow (T.) and Associates Ltd., Vancouver (British Columbia).
Kenneth C. Wilson.
Proc Amer Soc Civ Eng, J Power Div, Vol 95, No PO1, p 1-16, Mar 1969. 16 p, 7 fig, 1 ref, 2 append.

Descriptors: Hydraulic models, Hydraulics, Hydroelectric plants, Hydroelectric power, *Open channel flow, *Surges, *Tunnels, Head loss, *Waves (Water), Discharge (Water), Discharges, Digital computers, Foreign research, Laboratory tests, Hydraulic transients.
Identifiers: *Surge waves, *Portage Mtn Pwrplt (Can), Traveling waves, Canada, Foreign testing, Test results.

The discharge from the underground powerhouse at Portage Mountain, Canada, rejoins the Peace River through 2 large free-flow tunnels. Surge waves in these tunnels, caused by changes in turbine discharge, were studied by: (1) approximate manual calculations, (2) computer analysis, and (3) model testing. The surges are considered under 2 headings: determination of the initial extreme level following a flow change, and the more complicated conditions occurring after the return of surge waves reflected at the tunnel exit. Procedures used for manual and computer calculations are based directly on the momentum and continuity relationships because the great variation in surface breadth with the water level precludes using standard methods for surges in open channels. The tunnels are hydraulically short, permitting the configuration to be approximated by a level tunnel with friction losses lumped at the entrance and exit. Comparing results of the 3 methods of surge study indicates very satisfactory agreement. (USBR)
W69-08852

HYDRAULIC PERFORMANCE OF PENSTOCK TRIFURCATIONS,
Roorkee Univ. (India); and Birla Inst. of Technology and Science, Pilani (India).
Palepu V. Rao, H. C. Misra, and R. V. Juyal.
Proc Amer Soc Civ Eng, J Power Div, Vol 95, No PO1, p 35-53, Mar 1969. 19 p, 18 fig, 4 tab, 9 ref, 2 append.

Descriptors: *Penstocks, Energy dissipation, Energy losses, Models, *Hydraulic design, Hydraulic conduits, Hydraulics, Pipe bends, Model tests, Pressure distribution, Reynolds number, Velocity distribution, Cavitation, Foreign research.
Identifiers: Test results, *Trifurcations, Foreign testing, India.

Pressure distributions and energy losses were obtained in an air tunnel for the following penstock trifurcations: a 2-wye arrangement, 2 types of plug-funnel proposal, and an abrupt junction. Results of model studies of the tie bar trifurcation and other wyes are included to provide a comprehensive aid in selecting the right type of trifurcation. Model tests were made for 3 operating conditions: one branch flowing, 2 branches flowing, and all 3 branches flowing. Within the range of Reynolds numbers tested, the coefficients of the energy loss are independent of the Reynolds number. The plug-funnel trifurcation (central portion recessed) is hydraulically better than the other models tested when all 3 branches are flowing because the boundary geometry provides a smooth entry into all 3 branches. The double wye is superior when only one branch is flowing. (USBR)
W69-08853

8C. Hydraulic Machinery

THE PROBLEM OF FRAZIL ICE IN WATER INTAKES,
Laval Univ., Quebec.
B. Michel.
Pap, Univ Laval, Can, 15 p, 1963. Transl from Fr, Bur Reclam Transl 698, Apr 1967. 21 p, 11 fig, 9 ref.

Descriptors: *Frazil ice, Water temperature, *Intakes, Grills, *Intake structures, *Trash racks, Research and development, Heating, Hazards, Screens, Hydroelectric plants, Hydraulic turbines, Turbines, Foreign research.
Identifiers: Electric heating, Canada, Clogging.

Frazil ice can be a serious hazard to the operation of hydroelectric powerplants. Studies were made at Laval University, Canada, on the nature of frazil ice and methods of combatting it. Frazil ice can obstruct intakes by: (1) adhering as active frazil (frazil in the early stage of formation) to trashracks and grillwork, even to the bottom of the intake structure; (2) blocking as inactive frazil (older frazil that has lost its adhering characteristics but has formed into larger flakes and small plaques of ice) the partially obstructed openings by arching action; and (3) progressively clogging the turbines with active and, later, inactive frazil and producing shutdown of the hydroplant for the winter. Reservoir intakes should be located beneath the water in a manner to avoid frazil that could appear because of wind effect before surface icing. River intakes should not be located in rapids or immediately below rapids where frazil could form beneath a partial ice cover. Trashracks and grillwork should be equipped with heating capability for operation well before the appearance of active frazil ice. (USBR)
W69-08856

ON THE USE OF POWER FLOW MODELS FOR SYSTEM PLANNING AND OPERATIONS,
Bonneville Power Administration, Portland, Oreg.; and Wolf Management Services, Palo Alto, Calif.
For primary bibliographic entry see Field 07C.
W69-08869

THE INFLUENCE OF STATION DESIGN ON CONTROL CIRCUIT TRANSIENTS,
General Electric Co., Philadelphia, Pa.
W. C. Kotheimer.
Pap, Thirty-first Annu Amer Power Conv, Apr 1969. 18 p, 4 fig, 10 ref.

Descriptors: *Extra high voltage, *Substations (Electrical), Control, *Electromagnetic waves, Switchyards (Electrical), Electromagnetic shielding, *Interference, Circuits, Electric relays, Bus (Electrical), *Transients, *Electrical design, Conductors, Magnetic fields, Shielding, Electrical grounding.
Identifiers: *Ultra high voltage, *Induced voltage, Switching surges, Control equipment, Protection (Electrical), Magnetic links.

In ehv substations, interference originating during operation of a switching device can cause protective and control equipment to be damaged or to operate falsely. This phenomenon is electromagnetic interference, and control circuit transients present during switching operations have been measured in the thousands of volts. Fundamental principles of electromagnetic interference are discussed, relating them to factors in station design that can be manipulated to minimize control circuit transients. The 4 basic conditions that must be present to cause electromagnetic interference, surges, or control circuit problems are reviewed. Station design, proper shielding of control circuits, and coupling between ehv circuits and control circuits are very important as system voltages increase to the 765- and 1000-kv level. Transients in control circuits have been related in severity to the third power of the system voltage; transient levels in 1000-kv stations could be 8 times those present in 500-kv stations unless additional precautions are taken during design. (USBR)
W69-08870

SHUNT REACTOR COMPENSATION OF PRESENT AND FUTURE TRANSMISSION SYSTEMS,
General Electric Co., Schenectady, N.Y.
J. M. Feldman, and D. D. Wilson.
Pap, Thirty-first Annu Amer Power Conf, Apr 1969. 15 p, 9 fig, 9 ref, append.

Descriptors: *Reactance, Compensation, *Transmission lines, Testing, Transmission (Electrical), *Extra high voltage, Extra long distance, Economics, Maintenance costs, Installation costs, Analysis, Electric relays, Technology, Electrical design.
Identifiers: *Shunt reactors, Overvoltage, *Ultra high voltage, Switching surges, Protection (Electrical).

Shunt reactor technology, including design, testing, and application, is very important in the investment and operation of ehv and uhv transmission systems. The transmission voltage levels employing compensation cover the spectrum from 115 kv through 765 kv, with the majority of the approximately 15,000,000 kvar of installed or planned reactors applied on 345-kv and 500-kv systems. Reactor applications are almost evenly divided between installations at line voltage and reactors on tertiary windings of transformers, normally transmission-tie autotransformers. Continuing requirements for shunt reactors indicate the necessity of defining application and testing practices and the economics of various compensation schemes. An analysis of a reactor installation is given, indicating the necessity of economic analysis when applying shunt compensation. System requirements, reactor design, reactor testing, switching protection, and installation economics are discussed. (USBR)
W69-08871

8D. Soil Mechanics

EARTH STRUCTURES AND FOUNDATIONS SUBJECT TO SEISMIC LOADING,
Bureau of Reclamation, Denver, Colo.
H. J. Gibbs.

Pap, U S-Jap Coop Program Natur Resour (UJNR), Tokyo, Japan, Apr 1969. 19 p, 11 ref.

Descriptors: Seismic design, Seismic investigations, Seismic studies, Seismic properties, Soil density, *Soil dynamics, Shear strength, *Soil liquefaction, Cohesive soils, Cohesionless soils, Foundations, Relative density, Earthquake engineering, Penetration resistance, Soil strength, *Foundation investigations, Soil mechanics, Shear tests, Saturated soils.
Identifiers: *Earthquake loads, In situ tests, Saturated sand.

The large number of studies concerning soil behavior during earthquakes has yielded new concepts in investigation and design of earth structures and foundations. Liquefaction is a critical problem in low-density sands and silts when saturated and a real danger during earthquakes. The foundation engineer must determine the critical nature of in situ conditions. The standard penetration-resistance test is useful for evaluating relative density of sand deposits and checking this condition after densification. Laboratory tests of sands at various conditions, using cyclic loads and the number of cycles to represent earthquake effects, may be performed to determine shear stresses necessary for liquefaction and failure. Seismic coefficients and design earthquakes are selected from a review of the earthquake history in the construction area to compute expected shear stresses for comparison with shear stresses necessary to cause liquefaction. The practicing foundation engineer is concerned mostly with acceptable densities in sands susceptible to liquefaction and cohesive soils compacted in embankments. Details of laboratory tests and analyses provide variable limits of this property for different depths and types of soils. (USBR)
W69-08839

EFFECTS OF ENVIRONMENT ON THE PERFORMANCE OF SHALLOW FOUNDATIONS,
National Research Council of Canada, Saskatoon (Saskatchewan).
J. J. Hamilton.
Can Geotech J, Vol 6, No 1, p 65-80, Feb 1969. 16 p, 11 fig, 14 ref.

Descriptors: *Environmental effects, Environment, *Soil environment, *Foundations, Stress distribution, Foundation investigations, Swelling, Soil water movement, Soil mechanics, Soil moisture, Soil properties, Soil treatment, Expansive clays, Expansive soils, Construction, Thermal insulation.
Identifiers: Soil moisture movement, Swelling pressures, Construction methods.

Foundations for most structures have an important secondary function as part of the total building enclosure. When placed on subsoils sensitive to moisture changes, a separation of environments must be achieved without jeopardizing the primary requirement of stability. A general understanding of changes in stress and moisture conditions imposed on subsoils by various structures is a prerequisite for satisfactory foundation design. Control of heat and moisture flow in subsoils can be achieved by using insulation and vapor barriers. In many situations, these are most effective when placed on the outside of the foundations and should be installed at early stages of construction. Large volume increases result from relatively small reductions in confining pressure on swelling clays. These effects extend deeply into the underlying soils and cannot be corrected by shallow treatments. Additional large volume changes may also occur when deep-rooted vegetation is removed and water is available. Establishment and maintenance of reasonably uniform stress and moisture conditions in clay subsoils are principal requirements for satisfactory performance of shallow foundations. (USBR)
W69-08847

DETERMINATION OF LATERAL PRESSURES ASSOCIATED WITH CONSOLIDATION OF GRANULAR SOILS,
Bureau of Public Roads, Washington, D.C.
Vladimir F. Obrcian.
Pap, U S Dept Transp, Fed Highw Admin, Bur Public Roads, Jan 1969. 31 p, 13 fig, 2 tab, 13 ref.

Descriptors: *Consolidation, *Cohesionless soils, Soil tests, Poisson ratio, Soil properties, *Soil compression tests, Soil density, Friction, Soil mechanics, Laboratory tests, Test procedures, Prestressing, Stress, Strain, Loading rate, Preconsolidation.
Identifiers: *At rest pressure, Consolidometers.

One-dimensional consolidation of 4 granular soils was studied to determine the coefficient of earth pressure at rest, k sub zero. The consolidation apparatus permits gradual load application at a specified rate, while vertical and lateral stresses are observed simultaneously under the controlled condition of no lateral yielding. Load history of the deposit was simulated by vertical loading and unloading cycles. The soil specimens had a range of gradations and compactness commonly encountered in natural soils. Data demonstrate that k sub zero is less for the dense state than for the loose state and that it decreases with higher consolidation stress levels. Influence of gradation is also apparent from the results, but less pronounced. Approximate values of Poisson's ratio were computed from the data. The stress history studies, simulated by performing a number of unload and reload cycles starting at 3 different consolidation stress levels, demonstrated the locked-in or residual stress phenomenon associated with consolidation of soils subjected to cyclic loading. These studies emphasize the importance of considering the stress conditioning of soils that may be caused by the rolling of embankments or pavement layers. (USBR)
W69-08850

ANALYSIS AND DESIGN OF TOWER FOUNDATIONS,
Texas Power and Light Co., Dallas.
Richard L. Wiggins.
Proc Amer Soc Civ Eng, J Power Div, Vol 95, No PO1, p 77-100, Mar 1969. 24 p, 12 fig, 8 ref, 2 append.

Descriptors: *Footings, Foundations, *Transmission towers, Analysis, *Design criteria, Compression, Horizontal loads, Lateral forces, Soil mechanics, Testing, Reinforced concrete, Substations (Electrical), Cohesive soils, Soil pressure, Soil tests, Loads (Forces), Cohesionless soils, Transmission lines.
Identifiers: Uplift footings, *Auger-type footings, *Belled footings.

A comprehensive set of design procedures for drilled shaft-type tower foundations is presented. An analysis of various soil types, soil testing procedures, and interpretation of field and laboratory test results is included. Procedures are developed separately for horizontal shear, compression, and uplift in various soil types. The structural design of the reinforced concrete shaft for combined uplift and bending is presented as well as cases involving compression at extremely high eccentricities. Computer-generated design aids are presented, offering some relief from tedious calculations. Two simple design problems illustrate the developed procedures. The material and procedures presented should help in analyzing and designing foundations for transmission lines and substations. (USBR)
W69-08854

UPLIFT TEST ON AN ANCHOR BAR FOOTING - MEAD-LIBERTY TRANSMISSION LINE - PACIFIC NORTHWEST-PACIFIC SOUTHWEST INTERTIE,
Bureau of Reclamation, Denver, Colo.
James M. Horner.
Bur Reclam Rep No EM-765, Feb 1969. 38 p, 23 fig, 7 tab, 4 ref.

Descriptors: Foundations, Penetration resistance, Field tests, Shear strength, Soil properties, *Footings, Construction, Cohesive soils, Transmission towers, *Movement, Soil mechanics, Soil tests, Inspection, Loads (Forces), Arizona, *Loading rate.
Identifiers: Pacific Northwest-Southwest Intertie, Uplift resistance, Mead-Liberty Transmission Line, Anchored footings, Loading tests.

A full-size test to determine the movement of an anchor bar transmission tower footing under load was performed near Kingman, Ariz. The anchor bar footing consists of a reinforced concrete cap with 4 anchor bars (reinforcing bars surrounded by grout) extending out of the cap base downward into the soil. At the failure movement of 1/2 in., the uplift load was about 30 kips and the maximum uplift load resisted was 48 kips. Most footing movement was caused by rotation rather than translation. The soil resisting the footing movement was a sandy silt and a lean clay. For an individual anchor bar, soil strength values indicated that about 3.5 kips could be resisted, while a static analysis indicated that about 8.2 to 10.7 kips were actually resisted. The difference between computed and actual loads is attributed mainly to the following factors not included in the computations: (1) the direction of the load was oblique to the axis of the anchor bar, and (2) a 1-1/2-ft section of the grouted hole in a sand and gravel layer had an enlarged diameter. The analysis was complicated because the bottom one-third to one-half of the anchor bar reinforcements extended into soil outside the grouted holes. (USBR)
W69-08857

STABILITY OF DAMS IN PERMAFROST AREAS,
Alaska Univ., College.
Donald J. Gotschall.
Pap, Arctic Eng Class, Univ Alaska, Dec 1968. 14 p, 1 fig, 7 ref.

Descriptors: *Permafrost, Frost, Frost action, Frost heaving, Frozen ground, Frozen soils, Dam construction, Dam design, *Earth dams, Outlet works, *Rockfill dams, Heat flow, Dam foundations, *Stability, Cold weather construction, Spillways.
Identifiers: *Frozen core dams, USSR, Norway, Canada.

Stability of earth or rockfill dams built in permafrost areas requires that as much attention be given to the heat flow through a dam as is given to stopping the flow of water through a conventionally built dam. Heat flowing around abutments or through a frozen foundation will result in thawing the ice-soil mixture into a liquified state and invite failure. Earth dams have been built successfully in the arctic with and without frozen cores and on frozen and unfrozen foundations. Examples are given of permafrost dams built in the U S, Canada, Russia, and Norway. From the limited experience throughout the world, stability of earth and rockfill dams in a permafrost area is not an insurmountable problem. Heat flow through a zoned earthfill dam can be analyzed with an instrumented model or an analog computer. Rockfill can be used in the contact between frozen and thawed zones since rockfill drains easily and is not subject to movement when frozen. Other unusual construction and design techniques that have been used in permafrost are discussed. (USBR)
W69-08862

SLOPES IN STIFF-FISSURED CLAYS AND SHALES,
California Univ., Berkeley.
James M. Duncan, and Peter Dunlop.
Proc Amer Soc Civ Eng, J Soil Mech Found Div, Vol 95, No SM2, p 467-492, Mar 1969. 26 p, 20 fig, 3 tab, 44 ref, 2 append.

Descriptors: *Clays, Overconsolidation, Safety factors, *Shales, Shear stress, *Slope stability, Soil mechanics, Shear strength, Displacements, Stress analysis, Fissures, Computer programs, Normal stress, Pore pressure, Bibliographies, *Slopes.
Identifiers: Progressive failures, At rest pressure.

Case histories and probable causes of slope failures in stiff-fissured clays and shales are reviewed; analyses for determining the influence of initial stress conditions on stresses around excavated slopes are described. These analyses show that initial horizontal earth pressures have considerable influence on the magnitudes of shear stresses following construction. Shear stresses around excavated slopes are much larger for conditions representing a heavily overconsolidated clay (high initial horizontal stresses) than for conditions representing a normally consolidated clay (low initial horizontal stresses). Results indicate that shear stresses large enough to cause failure may develop at some points within the slopes, even though the factor of safety (according to the usual phi sub u= zero method) is considerably greater than unity. The higher the horizontal stresses before construction, the higher the factor of safety corresponding to development of local failure around the slope. The existence of high horizontal stresses in heavily overconsolidated clays and shales increases the probability of progressive failure in these materials. (USBR)
W69-08874

CORRELATION OF RAPID HYDROMETER ANALYSIS FOR SELECT MATERIAL TO EXISTING PROCEDURE LDH-TR-407-66,
Louisiana Dept. of Highways, Baton Rouge.
George W. Bass, and Marrion M. Cryer, Jr.
Res Proj No 67-1S, La Dept Highw, May 1968. 17 p, 6 tab, append.

Descriptors: *Gradation, *Gradation analysis, *Grain sizes, Base courses, *Hydrometers, Soil tests, Soil texture, Soil treatment, Soil classifications, Soil cement, Soil physical properties, Soil mechanics, *Laboratory tests, Statistical analysis, Soil stabilization, Test procedures.
Identifiers: Cement content.

The Louisiana Department of Highways has developed a standard procedure for rapid hydrometer analysis of soil samples to determine particle size distribution. The procedure will provide information in 24 hr instead of the 2-1/2 days required for former methods. Particle size distribution is needed for determining cement content for portland cement stabilized bases. The procedure requires removing material retained on the No. 4 and No. 10 sieves. Standard 100-g samples are ovendried and then mixed by hand with a stock solution of sodium hexametaphosphate buffered with sodium carbonate. The sample is washed into the dispersing cup and distilled water added. Dispersion by a mechanical stirring apparatus for 5 min precedes pouring the sample into 1000-ml sedimentation cylinders. Hydrometer readings are taken at 60 and 120 min. The sample is then washed over No. 40 and No. 200 mesh sieves and the retained material dried and weighed. Comparison with the standard laboratory method indicates equal accuracy and repeatability. (USBR)
W69-08875

EFFECTS OF WASTE EFFLUENTS ON THE PLASTICITY OF EARTH MATERIALS,
Illinois State Geological Survey, Urbana.
For primary bibliographic entry see Field 05C.
W69-08955

8E. Rock Mechanics and Geology

PREVENTING QUARRY ROCK FALLS,
R. M. Belliveau.
Pit Quarry, Vol 61, No 9, p 130-134, Mar 1969. 5 p, 6 photo.

Descriptors: *Rock excavation, *Rockslides, Quarries, *Quarrying, Rock properties, Mining engineering, Sliding, Slopes, *Engineering geology, Slope stabilization, Landslides, Geologic investigations, Safety.
Identifiers: *Rockfalls, *Rock slope stability, Rock competency, Open pit mining, Geologic defects, Benches.

Initial planning of quarry layout and operations is essential in preventing rock falls. Rock falls are manmade, resulting from deficient planning and inefficient operation. Geologic and mining engineering aspects are discussed for safe quarrying. Slides are usually caused by discontinuities in rock formations, such as bedding and faulting. Blasting disturbs the rock and induces slides. Operating practices are responsible for most situations resulting in slides and rock falls. Bench heights of 30 ft are recommended for ordinary operations; heights over 50 ft should not be used unless required by special considerations. In well-designed operations, the cost of mining high benches is greater than mining benches of 30 ft maximum height. (USBR)
W69-08833

NUCLEAR LOGGING METHODS,
Mobil Research and Development Corp., Dallas, Tex.
For primary bibliographic entry see Field 07B.
W69-08841

ANCHORAGE PERFORMANCE IN ROCK BOLTING,
Pennsylvania State Univ., University Park.
R. Stefanko, and D. S. Choi.
Prepr 69-F-61, Annu Meet Amer Inst Mining, Washington, D C, Feb 1969. 23 p, 9 fig, 7 ref.

Descriptors: *Rock bolts, Rock mechanics, Roof supports, Coal mines, Rocks, *Underground structures, Slipping, Suspension, Friction, Field tests, Laboratory tests, Design criteria.
Identifiers: Expansion bolts, Rock grip resin pack, Pull-out tests, Anchor bolts, Underground openings, Suspended structures.

Laboratory, field, and analytical investigations are described for designing rock bolts for a suspended monorail transportation system in an anthracite mine. Theoretical analysis of expansion shell anchorage was made to determine the yield of rock, the friction on the interface between the plug and expansion shell leaves, and the friction between the rock and leaf serrations. Serrations on the surface of expansion leaves increase friction, but may produce high stresses in the rock, causing failure and subsequent slippage. The analysis shows that the spacing between serrations is too small in most commercial shells. Laboratory tests gave widely varying bleedoff and installed load values for different rock and shell combinations, and substantiated the theoretical analysis that a reversal of serrations would improve anchorage. The variability in underground conditions prevents assessment of design parameters; field tests are necessary. With the present state of the art, pull tests and long-term bleedoff studies are essential for determining the best bolt assembly for a specific application. Field tests are discussed for roof bolts suspending the underground monorail, and bolt performance is being monitored periodically during operation.
W69-08858

8F. Concrete

RECOMMENDATIONS FOR CAST-IN-PLACE NONREINFORCED CONCRETE PIPE,
Ernest C. Fortier, Lawrence J. Booher, and Noel A. Negley.
J Amer Concr Inst, No 4, Proc V 66, p 252-269, Apr 1969. 18 p, 13 fig, 2 tab, 20 ref.

Descriptors: *Concrete pipes, Concrete placing, Concrete mixes, *Cast-in-place structures, Backfill, Pipelines, *Water pipes, *Trenches, Storm drains, Sewers, Excavation, Bibliographies, Inspection, Design criteria, Safety, Design data, Construction equipment, Curing, Concrete control, Formwork (Construction).
Identifiers: *Cast-in-place pipes, (Pipe design, Construction methods, Pipeline surges, Construction practices.

Present knowledge of nonreinforced cast-in-place concrete pipe is reviewed by American Concrete Institute Committee 346. Recommendations are given on design, construction, inspection, and safety precautions. Load tests and structural analysis show that nonreinforced concrete pipelines can sustain loads normally encountered by irrigation lines and sewers. Design recommendations are provided for pipeline locations, radius of curvature, coefficient of friction, protection against surges and water hammer, maximum surcharge load, foundation support, and pipe dimensions. Construction recommendations are included on trenching, concreting, and backfilling. Single-stage and 2-stage construction methods are described. (USBR)
W69-08849

SKEW REINFORCEMENT OF CONCRETE SLABS AGAINST BENDING AND TORSIONAL MOMENTS,
Engineering Labs., Cambridge (England).
C. T. Morley.
Inst Civ Eng Proc, Vol 42, p 57-74, Jan 1969. 18 p, 7 fig, 4 tab, 10 ref.

Descriptors: *Reinforced concrete, *Reinforcement, *Torsion, *Slabs, Load factors, *Bending moments, *Structural design, Plastic theory, Bending, Design, Design tools, Reinforcing steel, Foreign research, Stress.
Identifiers: *Skewness, Limit analysis.

A method is described for proportioning steel reinforcement in given, possibly skew, directions to resist bending and torsional moments at a point in a concrete slab. A formula is obtained for the strength of an under-reinforced slab with known areas of steel; this formula is then used to find the reinforcement necessary to resist a given set of bending and torsional moments, using the minimum total amount of steel. The method assumes that: (1) concrete has no tensile strength, (2) bar diameters are small in comparison with slab depth, (3) the slab is to be under-reinforced so that ductile failures will occur, and (4) the bars can carry stress only along their original axes. The basic approach is to use plasticity theory and limit analysis, and consider the ultimate strength of a reinforced concrete slab element subjected to bending and twisting moments. Steel is provided in accordance with the so-called load factor method of beam design to resist the elastic moment distribution according to the lower bound theorem of limit analysis. Sample design charts are presented and the design process is described for a single set of moments and for multiple sets due to different loading cases. (USBR)
W69-08861

CORRELATION OF RAPID HYDROMETER ANALYSIS FOR SELECT MATERIAL TO EXISTING PROCEDURE LDH-TR-407-66,
Louisiana Dept. of Highways, Baton Rouge.
For primary bibliographic entry see Field 08D.
W69-08875

8G. Materials

GALVANIC ACTION OF NEW LIQUID METAL PRIMER GIVES LASTING PROTECTION,
Ricallis Engineering Ltd, Manchester (England).
R. H. Herford.
Anti-Corros Methods Mater, Vol 16, No 2, p 17-19, Feb 1969. 3 p, 3 fig.

Descriptors: *Protective coatings, *Primers (Painting), Paints, Metal coatings, Zinc, Corrosion, *Corrosion control, Maintenance, Steel pipes, Cathodic protection, Steel structures, Metalwork.
Identifiers: Zinc pigmented paints, Corrosion inhibitors, Corrosion currents, Galvanic protection systems, Great Britain, Foreign products.

Many attempts have been made to develop zinc-rich paints for protecting steel from corrosion. Zinc-rich paints provide the reactions of cathodic protection, but are more convenient than zinc anodes in cathodic protection systems. Early experiences indicated that zinc did not react sufficiently with steel; a catalyst would be needed. Studies of the problem led to the development of a liquid metal primer. This primer contains other metals than zinc, such as chromium and cadmium, which are anodic to steel, and also may be added to aluminum. The metals are carried in a high-grade copolymer in a single solution of brushing consistency. When applied to steel, a cell is formed in which the primer is the anode, the steel is the cathode, and ambient moisture is the electrolyte. Measurable currents are generated, overcoming the corrosion currents. The primer expands and contracts with the steel; no cracking or crazing takes place. Japanese and British experiences with liquid metal primer are discussed. (USBR)
W69-08837

THE ECONOMICS OF CORROSION AND CORROSION CONTROL,
A. Holme.
Anti-Corros Methods Mater, Vol 16, No 2, p 12-17, Feb 1969. 5 p, 3 fig, 8 ref.

Descriptors: *Corrosion, *Corrosion control, Costs, *Cost comparisons, *Cost analysis, Accounting, Economics, Investment, Capital costs, Return (Monetary), Foreign design practices, Protective coatings, Discount rate, Monetary benefits.
Identifiers: Repayment, Great Britain.

The economic effects of corrosion of metals in Great Britain and the U S are reviewed; accounting methods are presented for evaluating the true costs of corrosion control. Corrosion control is an investment that may be appraised by the methods of investment appraisal used by accountants and economists. The main methods of appraising investment projects are: (1) payback, (2) annual rate of return, and (3) discounted cash flow. Each method is described and examples are given for comparing costs of corrosion protection systems. Corrosion control methods are analyzed to show the effects on the national economy. (USBR)
W69-08860

DESIGNING FOR CORROSION RESISTANCE,
Du Pont de Nemours (E. I.) and Co., Wilmington, Del.
R. James Landrum.
Chem Eng, p 118-124, 172-180, Feb-Mar 1969. 9 p, 22 fig, 7 ref.

Descriptors: Corrosion, *Corrosion control, Design, Butt joints, Steel structures, Fillet welds, Design criteria, Materials engineering, Steel, Materials failures, *Welding, Stainless steel, Temperature, Fabrication, Heat treatment, Fluids, Lap joints.
Identifiers: Corrosion environments, Corrosion resistance, Galvanic corrosion, Design practices, *Welds.

Corrosion resistance and service life under corrosive conditions are affected by construction materials, specifications, fabrication and inspection, operation, maintenance, and design. Service life is usually estimated from the corrosion resistance of the materials selected as determined by corrosion tests. Too little attention is paid to the effects of design details and other factors influencing corrosion, which can lead to early failures. A careful study of designs can detect design defects and find ways to avoid corrosive situations. Design details affecting corrosion are crevices, welding procedures, galvanic couples, heat treatment, environment, fluid drainage, velocity, and temperature. Designing for adequate performance at the lowest cost requires good judgment from the designer and the materials engineer. The materials engineer should work closely with the designer in selecting materials and design details to assure corrosion resistance. (USBR)
W69-08872

8H. Rapid Excavation

SUCCESSFUL OPERATION OF THE HABEGGER TUNNEL-BORING MACHINE IN HARD ROCK,
Habegger Machine Manufacturing Corp.
E. Lauber, and H. W. Brodbeck.
Schweiz Bauztg, Vol 86, No 51, p 917-924, Dec 1968. Transl from Ger, Bur Reclam Transl 812, Apr 1969. 21 p, 14 fig, 2 tab.

Descriptors: Tunnels, *Tunneling machines, *Tunneling, Engineering geology, Hardness tests, *Tunnel construction, Rock excavation, Slates, Rock properties, Rocks, Geologic investigations, Hardness, Conveyors, Quartz, Muck, *Boring machines, Foreign construction, Pressure tunnels, Sandstones.
Identifiers: Switzerland, Juliawerk Tiefencastel Proj (Switz), *Cutters.

The Habegger hard-rock tunneling machine was used in boring the high-pressure water tunnel for Juliawerk Tiefencastel Project, Switzerland. Experiences in tunneling, machine operation, and rock cutting are discussed. Improvements in designing cutters and developing cooled cutters are described. The machine steering system and a helium laser directional guide held horizontal and vertical deviations within 4 cm over 800 m. A scraper conveyor system was modified to successfully leave a clean floor while working in ground water. Comparing mechanical with conventional tunneling indicated that rock excavation costs are approximately equal. Problems of what is hard rock in regard to tunneling machines, rock properties for evaluation of rock cutting, and wear of cutters are covered. (USBR)
W69-08873

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Geological Survey, Washington, D.C. Water Resources Div.
For primary bibliographic entry see Field 07B.
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GLOSSARY OF TERMS USED IN FLUVIAL, DELTAIC, AND COASTAL MORPHOLOGY AND PROCESSES.
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
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A. Centers of Competence		
U.S. Geological Survey - Hydrology	W69-08695 -- 08737 08739 -- 08740 08742 -- 08771 08893 -- 08962 08773	146
University of Florida - Eastern U.S. Water Law	W69-08774 -- 08832 08878 -- 08886 08634, 08636, 08738, 08741, 08772, 08845, 08863, 08980, 09013, 09015	78
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B. Others:		
Forest Service - U.S. Department of Agriculture	W69-08639 -- 08666	28
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